

JMAP
REGENTS BY STATE
STANDARD: TOPIC

NY Algebra II Regents Exam Questions from
Spring 2015 to August 2025 Sorted by
State Standard: Topic

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Algebra II Regents Exam Questions by State Standard: Topic

RATE

F.IF.B.6: RATE OF CHANGE

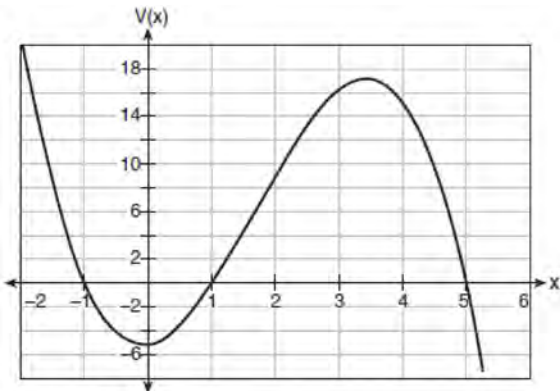
1 The population of Austin, Texas from 1850 to 2010 is summarized in the table below.

Year	1850	1870	1890	1910	1930	1950	1970	1990	2010
Population	629	4428	14,575	29,860	53,120	132,459	251,808	494,290	790,390

Over which period of time was the average rate of change in population the greatest?

- | | |
|----------------|----------------|
| 1 1850 to 1910 | 3 1950 to 1970 |
| 2 1990 to 2010 | 4 1890 to 1970 |

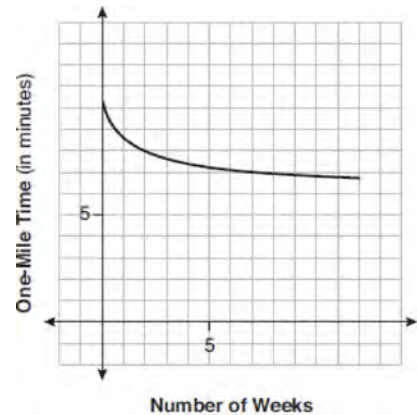
2 A cardboard box manufacturing company is building boxes with length represented by $x + 1$, width by $5 - x$, and height by $x - 1$. The volume of the box is modeled by the function below.



Over which interval is the volume of the box changing at the fastest average rate?

- 1 [1,2]
- 2 [1,3.5]
- 3 [1,5]
- 4 [0,3.5]

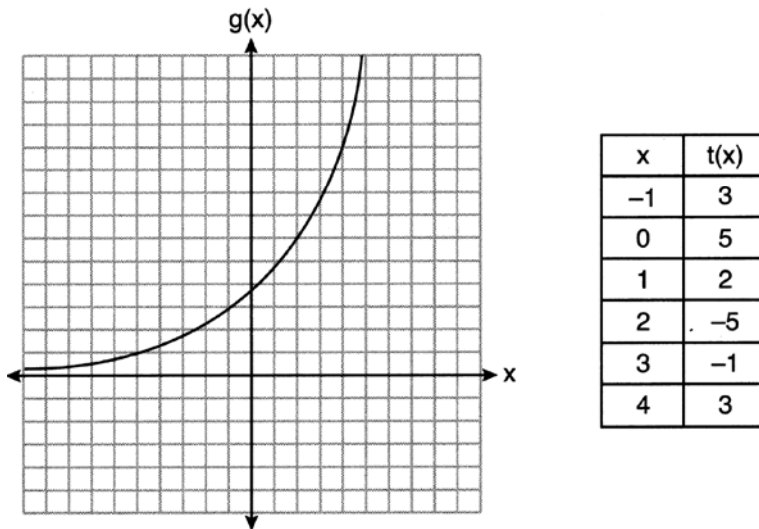
3 Irma initially ran one mile in over ten minutes. She then began a training program to reduce her one-mile time. She recorded her one-mile time once a week for twelve consecutive weeks, as modeled in the graph below.



Which statement regarding Irma's one-mile training program is correct?

- 1 Her one-mile speed increased as the number of weeks increased.
- 2 Her one-mile speed decreased as the number of weeks increased.
- 3 If the trend continues, she will run under a six-minute mile by week thirteen.
- 4 She reduced her one-mile time the most between weeks ten and twelve.

4 Consider the graph of g and the table representing t below.



Over the interval $[2, 4]$, which statement regarding the average rate of change for g and t is true?

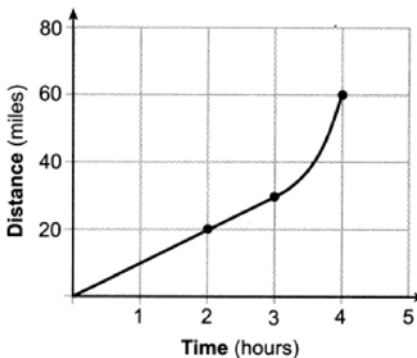
- 1 g has a greater average rate of change.
- 2 The average rates of change are equal.
- 3 The average rate of change for g is twice the average rate of change for t .
- 4 The average rate of change for g is half the average rate of change for t .

5 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

Speed (mph)	10	20	30	40	50	60	70
Distance (ft)	6.25	25	56.25	100	156.25	225	306.25

Determine the average rate of change in braking distance, in ft/mph, between one car traveling at 50 mph and one traveling at 70 mph. Explain what this rate of change means as it relates to braking distance.

6 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.



- 12 A fruit fly population can be modeled by the equation $P = 10(1.27)^t$, where P represents the number of fruit flies after t days. What is the average rate of change of the population, rounded to the *nearest hundredth*, over the interval $[0, 10.5]$? Include appropriate units in your answer.
- 13 An initial investment of \$1000 reaches a value, $V(t)$, according to the model $V(t) = 1000(1.01)^{4t}$, where t is the time in years. Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.
- 14 In the town of Skaneateles, New York, house prices since 2008 have changed based on the function $H(t) = 200,000(1.045)^t$, where t is the number of years since 2008 and $H(t)$ is the median house price. Determine the average rate of change for the median house price in Skaneateles, from 2010 to 2018 to the *nearest dollar per year*. Explain what this rate of change means as it relates to median house prices.
- 15 The world population was 2560 million people in 1950 and 3040 million in 1960 and can be modeled by the function $p(t) = 2560e^{0.017185t}$, where t is time in years after 1950 and $p(t)$ is the population in millions. Determine the average rate of change of $p(t)$ in millions of people per year, from $4 \leq t \leq 8$. Round your answer to the *nearest hundredth*.
- 16 Which function has a greater average rate of change on the interval $[-1, 4]$? Justify your answer.

x	$m(x)$
-2	-3
-1	1
0	1
1	3
2	13
3	37
4	81
5	151

$$p(x) = 3^x + 1$$

17 Which function shown below has a greater average rate of change on the interval $[-2,4]$? Justify your answer.

x	f(x)
-4	0.3125
-3	0.625
-2	1.25
-1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

$$g(x) = 4x^3 - 5x^2 + 3$$

18 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900. The population of India since 1900 is summarized in the table below:

Years since 1900	Population (millions)
0	243
10	254
20	268
30	285
40	324
50	376.3
60	450.6
70	555.1
80	699
90	873.3
100	1056.6
110	1234.3
120	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

- 19 The table below shows the number of hours of daylight on the first day of each month in Rochester, NY.

Month	Hours of Daylight
Jan.	9.4
Feb.	10.6
March	11.9
April	13.9
May	14.7
June	15.4
July	15.1
Aug.	13.9
Sept.	12.5
Oct.	11.1
Nov.	9.7
Dec.	9.0

Given the data, what is the average rate of change in hours of daylight per month from January 1st to April 1st? Interpret what this means in the context of the problem.

- 20 The function $f(x) = 2^{-0.25x} \cdot \sin\left(\frac{\pi}{2}x\right)$ represents a damped sound wave function. What is the average rate of change for this function on the interval $[-7, 7]$, to the *nearest hundredth*?
- 1 -3.66
 - 2 -0.30
 - 3 -0.26
 - 4 3.36
- 21 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29 \sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November. Explain its meaning in the given context.
- 22 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9 \sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1. Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*. Explain what this value represents in the given context.

QUADRATICS

N.CN.A.2: IMAGINARY NUMBERS

- 23 Given i is the imaginary unit and $a = i^3$, $b = i^2$, and $c = i$, which expression is equivalent to $2ax^2 + 3bx - cx$?
- 1 $-2ix^2 - 3x + ix$
 - 2 $-2ix^2 - 3ix$
 - 3 $-2ix^2 - 3x - ix$
 - 4 $-8ix^3 - 3x - ix$
- 24 Express $8xi^{10} - 4yi^{19} + 2yi^3 - 6xi$ in simplest form, where i is the imaginary unit.

N.CN.A.2: OPERATIONS WITH COMPLEX NUMBERS

- 25 The expression $3i(ai - 6i^2)$ is equivalent to
- $3a + 18i$
 - $3a - 18i$
 - $-3a + 18i$
 - $-3a - 18i$
- 26 The expression $6xi^3(-4xi + 5)$ is equivalent to
- $2x - 5i$
 - $-24x^2 - 30xi$
 - $-24x^2 + 30x - i$
 - $26x - 24x^2i - 5i$
- 27 If $A = -3 + 5i$, $B = 4 - 2i$, and $C = 1 + 6i$, where i is the imaginary unit, then $A - BC$ equals
- $5 - 17i$
 - $5 + 27i$
 - $-19 - 17i$
 - $-19 + 27i$
- 28 Given that i is the imaginary unit, the expression $(x - 2i)^2$ is equivalent to
- $x^2 + 4$
 - $x^2 - 4$
 - $x^2 - 2xi - 4$
 - $x^2 - 4xi - 4$
- 29 Given i is the imaginary unit, $(2 - yi)^2$ in simplest form is
- $y^2 - 4yi + 4$
 - $-y^2 - 4yi + 4$
 - $-y^2 + 4$
 - $y^2 + 4$
- 30 Which expression is equivalent to $(3k - 2i)^2$, where i is the imaginary unit?
- $9k^2 - 4$
 - $9k^2 + 4$
 - $9k^2 - 12ki - 4$
 - $9k^2 - 12ki + 4$
- 31 The expression $i^2(5x - 2i)^2$ is equivalent to
- $-25x^2 + 20xi - 4$
 - $-25x^2 + 20xi + 4$
 - $25x^2 + 20xi + 4$
 - $25x^2 + 4$
- 32 The expression $6 - (3x - 2i)^2$ is equivalent to
- $-9x^2 + 12xi + 10$
 - $9x^2 - 12xi + 2$
 - $-9x^2 + 10$
 - $-9x^2 + 12xi - 4i + 6$
- 33 Where i is the imaginary unit, the expression $(x + 3i)^2 - (2x - 3i)^2$ is equivalent to
- $-3x^2$
 - $-3x^2 - 18$
 - $-3x^2 + 18xi$
 - $-3x^2 - 6xi - 18$
- 34 Which expression is equivalent to $(2x - i)^2 - (2x - i)(2x + 3i)$ where i is the imaginary unit and x is a real number?
- $-4 - 8xi$
 - $-4 - 4xi$
 - 2
 - $8x - 4i$
- 35 Expressed in simplest $a + bi$ form, $(7 - 3i) + (x - 2i)^2 - (4i + 2x^2)$ is
- $(3 - x^2) - (4x + 7)i$
 - $(3 + 3x^2) - (4x + 7)i$
 - $(3 - x^2) - 7i$
 - $(3 + 3x^2) - 7i$
- 36 Which expression is equivalent to $(x + yi)(x^2 - xyi - y^2)$, where i is the imaginary unit?
- $x^3 + y^3i$
 - $x^3 - x^2y - (xy^2 + y^3)i$
 - $x^3 - 2xy^2 - y^3i$
 - $x^3 - y^3i$

37 Given i is the imaginary unit, which expression is equivalent to $5i(2x + 3i) - x\sqrt{-9}$?

- 1 $15 + 13xi$
- 2 $-15 + 13xi$
- 3 $15 + 7xi$
- 4 $-15 + 7xi$

38 If $(6 - ki)^2 = 27 - 36i$, the value of k is

- 1 -36
- 2 -3
- 3 3
- 4 6

39 Simplify $xi(i - 7i)^2$, where i is the imaginary unit.

40 Given i is the imaginary unit, simplify $(5xi^3 - 4i)^2$ as a polynomial in standard form.

41 Express $(2xi^3 - 3y)^2$ in simplest form.

42 Express $(1 - i)^3$ in $a + bi$ form.

43 Given x is a real number, write the expression in simplest $a + bi$ form: $(x + 2i)(3 - 2xi) + 2x^2i$

44 Write $(5 + 2yi)(4 - 3i) - (5 - 2yi)(4 - 3i)$ in $a + bi$ form, where y is a real number.

45 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

46 Elizabeth tried to find the product of $(2 + 4i)$ and $(3 - i)$, and her work is shown below.

$$\begin{aligned} & (2 + 4i)(3 - i) \\ &= 6 - 2i + 12i - 4i^2 \\ &= 6 + 10i - 4i^2 \\ &= 6 + 10i - 4(1) \\ &= 6 + 10i - 4 \\ &= 2 + 10i \end{aligned}$$

Identify the error in the process shown and determine the correct product of $(2 + 4i)$ and $(3 - i)$.

A.REI.B.4: SOLVING QUADRATICS

47 The solution to the equation $4x^2 + 98 = 0$ is

- 1 ± 7
- 2 $\pm 7i$
- 3 $\pm \frac{7\sqrt{2}}{2}$
- 4 $\pm \frac{7i\sqrt{2}}{2}$

48 What is the solution when the equation $wx^2 + w = 0$ is solved for x , where w is a positive integer?

- 1 -1
- 2 0
- 3 6
- 4 $\pm i$

49 The roots of the equation $x^2 + 2x + 5 = 0$ are

- 1 -3 and 1
- 2 -1 , only
- 3 $-1 + 2i$ and $-1 - 2i$
- 4 $-1 + 4i$ and $-1 - 4i$

50 The roots of the equation $0 = x^2 + 6x + 10$ in simplest $a + bi$ form are

- 1 $-3 \pm 2i$
- 2 $-6 \pm i$
- 3 $-3 \pm i$
- 4 $-3 \pm i\sqrt{2}$

51 The roots of the equation $x^2 - 4x = -13$ are

- 1 $2 \pm 3i$
- 2 $2 \pm 6i$
- 3 $2 \pm \sqrt{17}$
- 4 $2 \pm \sqrt{13}$

52 The solutions to the equation $-\frac{1}{2}x^2 = -6x + 20$ are

- 1 $-6 \pm 2i$
- 2 $-6 \pm 2\sqrt{19}$
- 3 $6 \pm 2i$
- 4 $6 \pm 2\sqrt{19}$

53 A solution of the equation $2x^2 + 3x + 2 = 0$ is

- 1 $-\frac{3}{4} + \frac{1}{4}i\sqrt{7}$
- 2 $-\frac{3}{4} + \frac{1}{4}i$
- 3 $-\frac{3}{4} + \frac{1}{4}\sqrt{7}$
- 4 $\frac{1}{2}$

54 The roots of the equation $3x^2 + 2x = -7$ are

- 1 $-2, -\frac{1}{3}$
- 2 $-\frac{7}{3}, 1$
- 3 $-\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}$
- 4 $-\frac{1}{3} \pm \frac{\sqrt{11}}{3}$

55 What are the solutions to $4x^2 - 7x - 2 = -10$

- 1 $-\frac{1}{4}, 2$
- 2 $\frac{7}{8} \pm \frac{\sqrt{79}}{8}i$
- 3 $\frac{7}{8} \pm \frac{\sqrt{241}}{8}$
- 4 $\frac{7}{8} \pm \frac{\sqrt{143}}{8}i$

56 The solutions to the equation $5x^2 - 2x + 13 = 9$ are

- 1 $\frac{1}{5} \pm \frac{\sqrt{21}}{5}$
- 2 $\frac{1}{5} \pm \frac{\sqrt{19}}{5}i$
- 3 $\frac{1}{5} \pm \frac{\sqrt{66}}{5}i$
- 4 $\frac{1}{5} \pm \frac{\sqrt{66}}{5}$

57 The solution to the equation $18x^2 - 24x + 87 = 0$ is

- 1 $-\frac{2}{3} \pm 6i\sqrt{158}$
- 2 $-\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$
- 3 $\frac{2}{3} \pm 6i\sqrt{158}$
- 4 $\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$

58 The solutions to the equation $3x^2 - 4x + 2 = 2x - 3$ are

- 1 $\frac{2}{3} \pm \frac{\sqrt{2}}{3}i$
- 2 $1 \pm \frac{\sqrt{6}}{3}i$
- 3 $1 \pm \frac{\sqrt{12}}{3}$
- 4 $1 \pm 2\sqrt{6}i$

59 If a solution of $2(2x - 1) = 5x^2$ is expressed in simplest $a + bi$ form, the value of b is

- 1 $\frac{\sqrt{6}}{5}i$
- 2 $\frac{\sqrt{6}}{5}$
- 3 $\frac{1}{5}i$
- 4 $\frac{1}{5}$

60 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

61 Algebraically determine the solution(s) to the equation $2x^2 = 2x - 1$, in simplest $a + bi$ form.

62 Solve the equation $2x^2 + 5x + 8 = 0$. Express the answer in $a + bi$ form.

63 Solve the equation $3x^2 + 5x + 8 = 0$. Write your solution in $a + bi$ form.

- 64 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

- b) Consider the system of equations below.

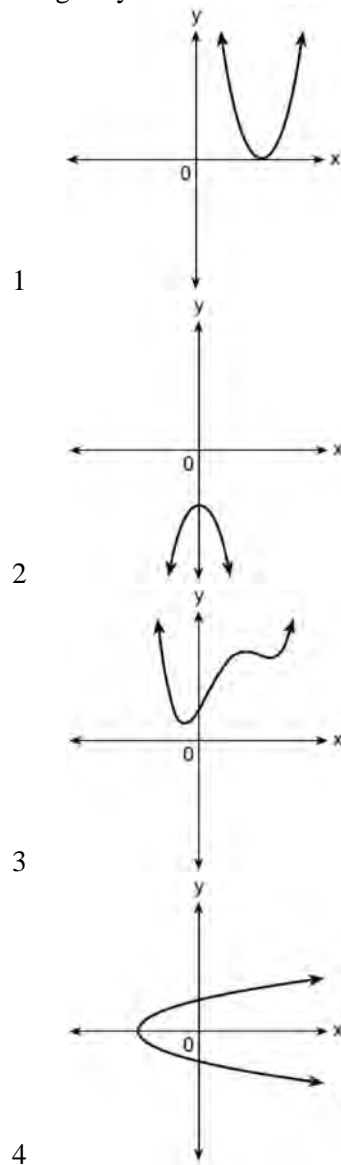
$$y = x^2 - 2x + 7$$

$$y = 4x - 10$$

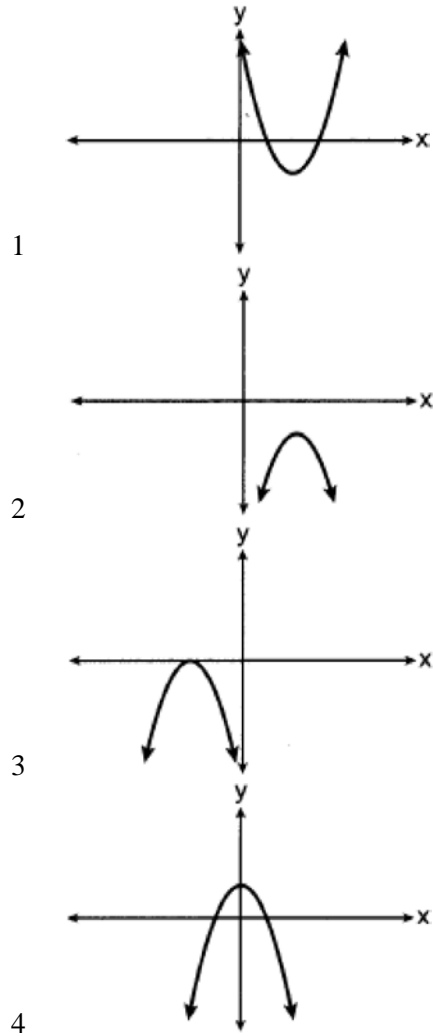
The graph of this system confirms the solution from part a is imaginary. Explain why.

A.REI.B.4: USING THE DISCRIMINANT

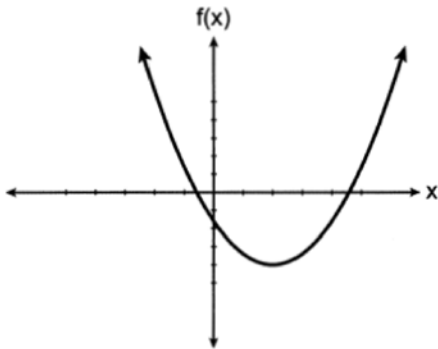
- 65 Which graph shows a quadratic function with two imaginary zeros?



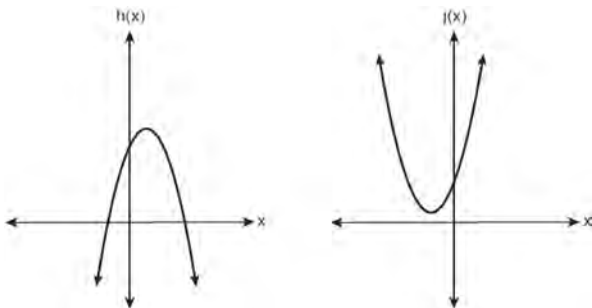
- 66 Which graph has imaginary roots?



- 67 If $f(x)$ is represented by the graph below, which translation of $f(x)$ would have imaginary roots?



- 1 $f(x + 5)$
 - 2 $f(x - 5)$
 - 3 $f(x) + 5$
 - 4 $f(x) - 5$
- 68 In the quadratic formula, $b^2 - 4ac$ is called the discriminant. The function $f(x)$ has a discriminant value of 8, and $g(x)$ has a discriminant value of -16 . The quadratic graphs, $h(x)$ and $j(x)$, are shown below.

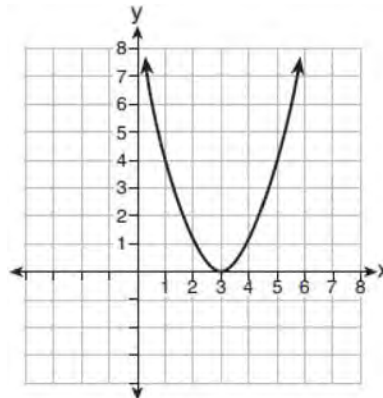


Which quadratic functions have imaginary roots?

- 69 Which representation of a quadratic has imaginary roots?

x	y
-2.5	2
-2.0	0
-1.5	-1
-1.0	-1
-0.5	0
0.0	2

- 1
- 2 $2(x + 3)^2 = 64$



- 3
- 4 $2x^2 + 32 = 0$

- 70 Does the equation $x^2 - 4x + 13 = 0$ have imaginary solutions? Justify your answer.

A.REI.B.4: COMPLEX CONJUGATE ROOT THEOREM

- 71 Which equation has roots of $3 + i$ and $3 - i$?

- 1 $x^2 - 6x + 10 = 0$
- 2 $x^2 + 6x - 10 = 0$
- 3 $x^2 - 10x + 6 = 0$
- 4 $x^2 + 10x - 6 = 0$

- 72 Which equation has $1 - i$ as a solution?

- 1 $x^2 + 2x - 2 = 0$
- 2 $x^2 + 2x + 2 = 0$
- 3 $x^2 - 2x - 2 = 0$
- 4 $x^2 - 2x + 2 = 0$

POLYNOMIALS

A.SSE.A.2: FACTORING POLYNOMIALS

- 73 When the expression $(x+2)^2 + 4(x+2) + 3$ is rewritten as the product of two binomials, the result is
- 1 $(x+3)(x+1)$
 - 2 $(x+5)(x+3)$
 - 3 $(x+2)(x+2)$
 - 4 $(x+6)(x+1)$
- 74 Which expression is equivalent to $(x+2)^2 - 5(x+2) + 6$?
- 1 $x(x-1)$
 - 2 $(x-3)(x-2)$
 - 3 $(x-4)(x+3)$
 - 4 $(x-6)(x+1)$
- 75 Which expression is equivalent to $(x+3)^2 + 4(x+3) - 5$?
- 1 $(x+5)(x-1)$
 - 2 $(x+8)(x+2)$
 - 3 $(x-2)(x+4)$
 - 4 $x^2 + 4x + 16$
- 76 The expression $(x+a)^2 + 5(x+a) + 4$ is equivalent to
- 1 $(a+1)(a+4)$
 - 2 $(x+1)(x+4)$
 - 3 $(x+a+1)(x+a+4)$
 - 4 $x^2 + a^2 + 5x + 5a + 4$
- 77 Which expression is equivalent to $(x-2)^2 + 27(x-2) - 90$?
- 1 $(x+30)(x-3)$
 - 2 $(x+28)(x-5)$
 - 3 $(x-30)(x+3)$
 - 4 $(x-2)(x+25)(x-90)$
- 78 The expression $(x^2+3)^2 - 2(x^2+3) - 24$ is equivalent to
- 1 $(x^2+9)(x^2-1)$
 - 2 $(x^2-3)(x^2+7)$
 - 3 $x^4 - 2x^2 - 21$
 - 4 $x^4 + 4x^2 - 9$
- 79 When factored completely, $(3x-1)^2 - 5(3x-1) + 6$ is equivalent to
- 1 $(3x-3)(3x-4)$
 - 2 $3x(3x-7)$
 - 3 $3(x-1)(3x-4)$
 - 4 $(3x+1)(3x-2)$
- 80 If $(a^3 + 27) = (a+3)(a^2 + ma + 9)$, then m equals
- 1 -9
 - 2 -3
 - 3 3
 - 4 6
- 81 When factored completely, $m^5 + m^3 - 6m$ is equivalent to
- 1 $(m+3)(m-2)$
 - 2 $(m^2 + 3m)(m^2 - 2)$
 - 3 $m(m^4 + m^2 - 6)$
 - 4 $m(m^2 + 3)(m^2 - 2)$
- 82 Which expression is equivalent to $x^6y^4(x^4 - 16) - 9(x^4 - 16)$?
- 1 $x^{10}y^4 - 16x^6y^4 - 9x^4 - 144$
 - 2 $(x^6y^4 - 9)(x+2)^3(x-2)$
 - 3 $(x^3y^2 + 3)(x^3y^2 - 3)(x+2)^2(x-2)^2$
 - 4 $(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$
- 83 Which expression is *not* equivalent to $36x^6 - 25y^4$?
- 1 $6^2(x^3)^2 - 5^2(y^2)^2$
 - 2 $(6x^3 - 5y^2)(6x^3 + 5y^2)$
 - 3 $(6x^6 - 5y^4)(6x^6 + 5y^4)$
 - 4 $(3 \bullet 2x^3 - 5y^2)(3 \bullet 2x^3 + 5y^2)$

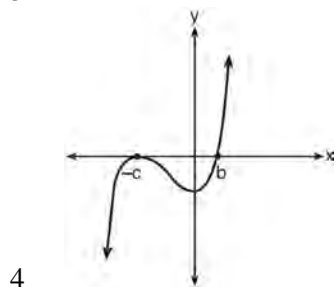
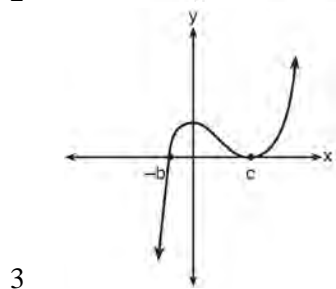
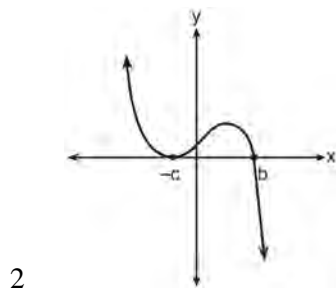
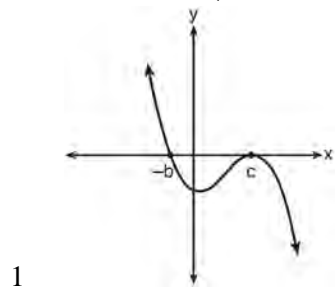
- 84 Which expression is equivalent to $x^8 - y^8$?
- $(x - y)^8$
 - $(x^2 + y^2)^2(x^2 - y^2)^2$
 - $(x^4 + y^4)(x^2 + y^2)(x + y)(x - y)$
 - $(x + y)^4(x - y)^4$
- 85 Factored completely, $x^4 + 4x^3 - 9x^2 - 36x$ is equivalent to
- $x(x + 9)(x - 9)(x + 4)$
 - $x(x + 3)(x - 3)(x + 4)$
 - $(x^3 - 9x)(x + 4)$
 - $x(x^2 - 9)(x + 4)(x + 4)$
- 86 The completely factored form of $2d^4 + 6d^3 - 18d^2 - 54d$ is
- $2d(d^2 - 9)(d + 3)$
 - $2d(d^2 + 9)(d + 3)$
 - $2d(d + 3)^2(d - 3)$
 - $2d(d - 3)^2(d + 3)$
- 87 What is the completely factored form of $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$?
- $(k - 2)(k - 2)(k + 3)(k + 4)$
 - $(k - 2)(k - 2)(k + 6)(k + 2)$
 - $(k + 2)(k - 2)(k + 3)(k + 4)$
 - $(k + 2)(k - 2)(k + 6)(k + 2)$
- 88 The completely factored form of $n^4 - 9n^2 + 4n^3 - 36n - 12n^2 + 108$ is
- $(n^2 - 9)(n + 6)(n - 2)$
 - $(n + 3)(n - 3)(n + 6)(n - 2)$
 - $(n - 3)(n - 3)(n + 6)(n - 2)$
 - $(n + 3)(n - 3)(n - 6)(n + 2)$
- 89 Which factorization is *incorrect*?
- $4k^2 - 49 = (2k + 7)(2k - 7)$
 - $a^3 - 8b^3 = (a - 2b)(a^2 + 2ab + 4b^2)$
 - $m^3 + 3m^2 - 4m + 12 = (m - 2)^2(m + 3)$
 - $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$
- 90 Which expression has been rewritten correctly to form a true statement?
- $(x + 2)^2 + 2(x + 2) - 8 = (x + 6)x$
 - $x^4 + 4x^2 + 9x^2y^2 - 36y^2 = (x + 3y)^2(x - 2)^2$
 - $x^3 + 3x^2 - 4xy^2 - 12y^2 = (x - 2y)(x + 3)^2$
 - $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$
- 91 Over the set of integers, factor the expression $x^4 - 4x^2 - 12$.
- 92 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.
- 93 Factor the expression $x^3 - 2x^2 - 9x + 18$ completely.
- 94 Factor $x^3 + 4x^2 - 9x - 36$ completely.
- 95 Factor the expression $2x^3 - 3x^2 - 18x + 27$ completely.
- 96 Over the set of integers, factor the expression $4x^3 - x^2 + 16x - 4$ completely.
- 97 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.
- 98 Factor completely over the set of integers: $-2x^4 + x^3 + 18x^2 - 9x$
- 99 Completely factor the following expression: $x^2 + 3xy + 3x^3 + y$
- 100 Factor the expression completely: $(x - 1)^2 + 5(x - 1) - 6$
- 101 Rewrite the expression $(4x^2 + 5x)^2 - 5(4x^2 + 5x) - 6$ as a product of four linear factors.

A.APR.B.3: SOLVING POLYNOMIAL EQUATIONS

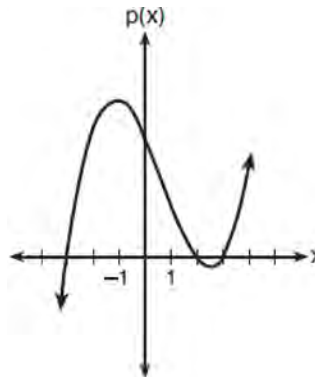
- 102 When factoring to reveal the roots of the equation $x^3 + 2x^2 - 9x - 18 = 0$, which equations can be used?
- $x^2(x + 2) - 9(x + 2) = 0$
 - $x(x^2 - 9) + 2(x^2 - 9) = 0$
 - $(x - 2)(x^2 - 9) = 0$
- I and II, only
 - I and III, only
 - II and III, only
 - I, II, and III
- 103 Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is
- ± 2
 - 2, only
 - $2i, 2$
 - $\pm 2i, 2$
- 104 Evan graphed a cubic function, $f(x) = ax^3 + bx^2 + cx + d$, and determined the roots of $f(x)$ to be ± 1 and 2. What is the value of b , if $a = 1$?
- 1
 - 2
 - 1
 - 2
- 105 Which statement regarding polynomials and their zeros is true?
- $f(x) = (x^2 - 1)(x + a)$ has zeros of 1 and $-a$, only.
 - $f(x) = x^3 - ax^2 + 16x - 16a$ has zeros of 4 and a , only.
 - $f(x) = (x^2 + 25)(x + a)$ has zeros of ± 5 and $-a$.
 - $f(x) = x^3 - ax^2 - 9x + 9a$ has zeros of ± 3 and a .
- 106 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?
- 2 and -2, only
 - 2, -2, and -4
 - 4, i , and $-i$
 - 2, -2, i , and $-i$
- 107 Given $f(x) = x^4 + x^3 - 3x^2 + 9x - 108$ and $f(3) = 0$, which values satisfy $f(x) = 0$?
- 4, 3 only
 - 3, 4 only
 - $\pm 3i, -4, 3$
 - $\pm 3i, -3, 4$
- 108 The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are
- $\{0, \pm 3, 4\}$
 - $\{0, 3, 4\}$
 - $\{0, \pm 3, -4\}$
 - $\{0, 3, -4\}$
- 109 What are the zeros of $s(x) = x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90$?
- $\{-3, -2, 5\}$
 - $\{-2, 3, 5\}$
 - $\{-3, -2, 3, 5\}$
 - $\{-5, -3, 2, 3\}$
- 110 Given 3 is a root of $f(x) = x^4 - x^3 - 21x^2 + 45x$, what are the other unique roots of $f(x)$?
- 5, only
 - 5 and 0
 - 3, 1 and 5
 - 5, -3 and 0
- 111 Algebraically determine the zeros of the function below.
- $$r(x) = 3x^3 + 12x^2 - 3x - 12$$
- 112 Given $z(x) = 6x^3 + bx^2 - 52x + 15$, $z(2) = 35$, and $z(-5) = 0$, algebraically determine all the zeros of $z(x)$.

A.APR.B.3: GRAPHING POLYNOMIAL FUNCTIONS

113 If a , b , and c are all positive real numbers, which graph could represent the sketch of the graph of $p(x) = -a(x+b)(x^2 - 2cx + c^2)$?



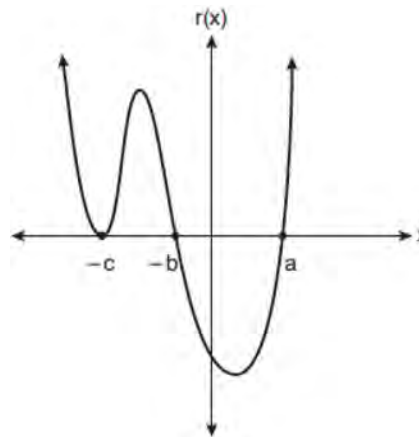
114 The graph of the function $p(x)$ is sketched below.



Which equation could represent $p(x)$?

- 1 $p(x) = (x^2 - 9)(x - 2)$
- 2 $p(x) = x^3 - 2x^2 + 9x + 18$
- 3 $p(x) = (x^2 + 9)(x - 2)$
- 4 $p(x) = x^3 + 2x^2 - 9x - 18$

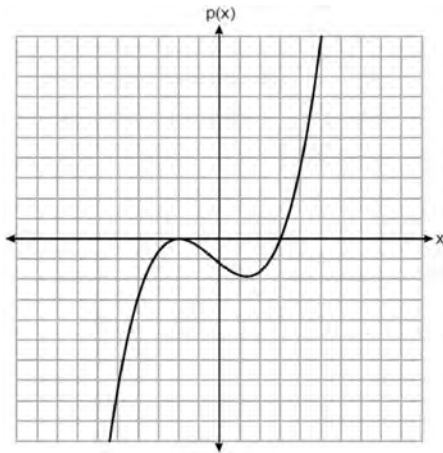
115 A sketch of $r(x)$ is shown below.



An equation for $r(x)$ could be

- 1 $r(x) = (x - a)(x + b)(x + c)$
- 2 $r(x) = (x + a)(x - b)(x - c)^2$
- 3 $r(x) = (x + a)(x - b)(x - c)$
- 4 $r(x) = (x - a)(x + b)(x + c)^2$

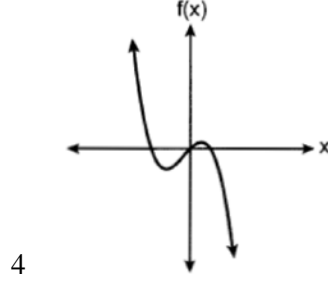
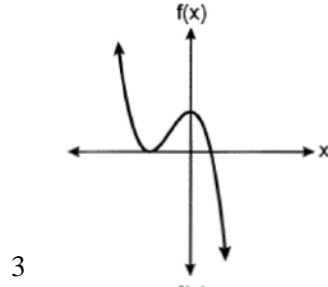
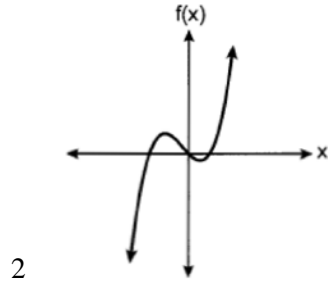
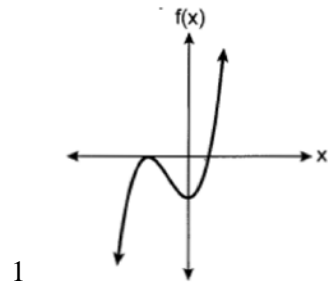
116 The graph of a cubic polynomial function $p(x)$ is shown below.



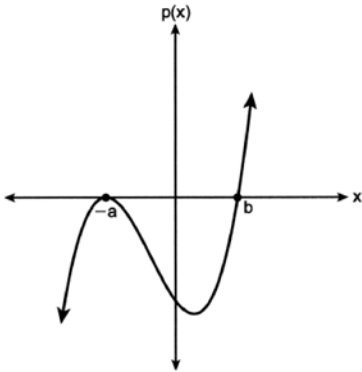
If $p(x)$ is written as a product of linear factors, which factor would appear twice?

- 1 $x - 2$
- 2 $x + 2$
- 3 $x - 3$
- 4 $x + 3$

117 Which graph best represents the graph of $f(x) = (x + a)^2(x - b)$, where a and b are positive real numbers?



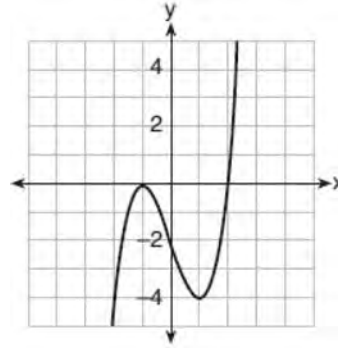
118 A sketch for $p(x)$ is shown below, where $a > 0$ and $b > 0$.



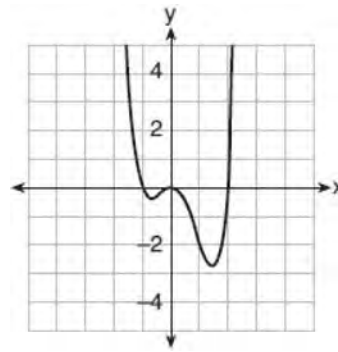
An equation for $p(x)$ could be

- 1 $p(x) = (x + a)(x - b)$
- 2 $p(x) = (x + a)^2(x - b)$
- 3 $p(x) = (x - a)(x + b)$
- 4 $p(x) = (x - a)^2(x + b)$

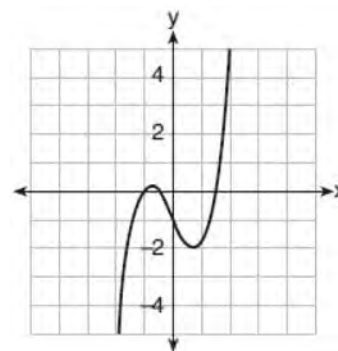
119 Which graph represents a polynomial function that contains $x^2 + 2x + 1$ as a factor?



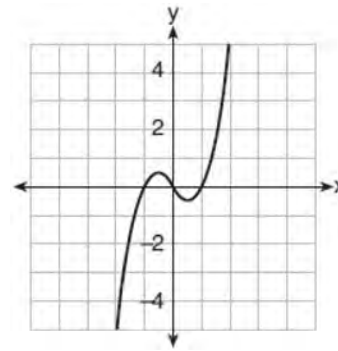
1



2

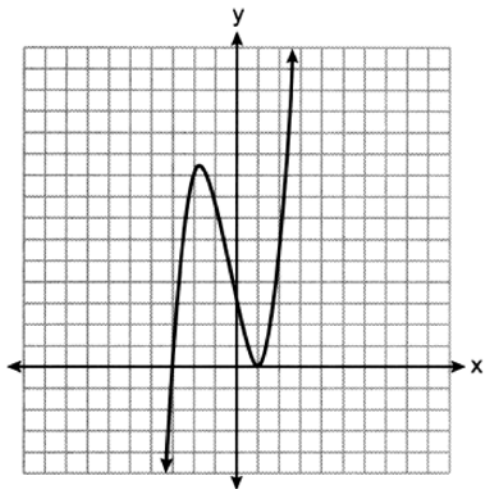


3



4

- 120 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.

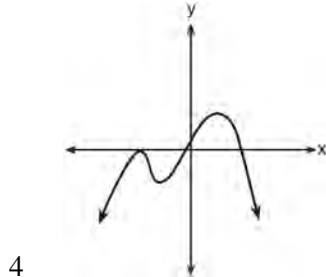
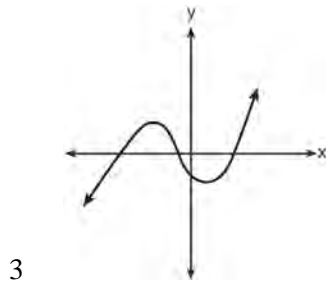
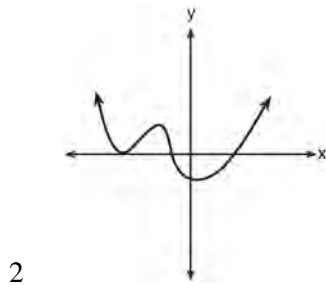
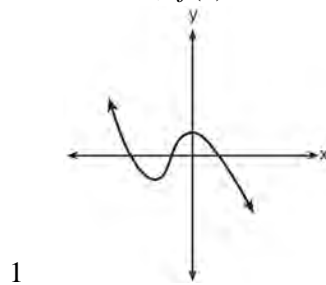


Write an equation for $f(x)$.

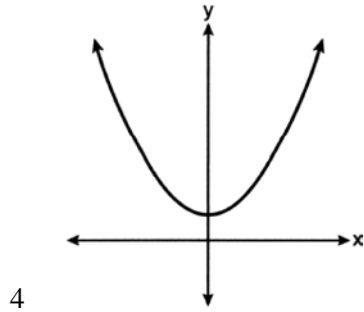
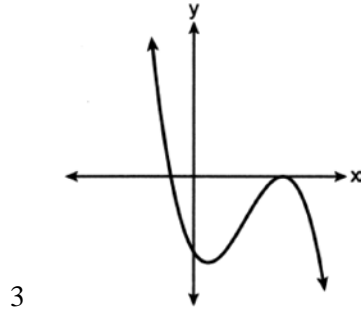
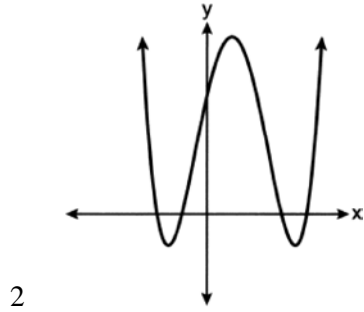
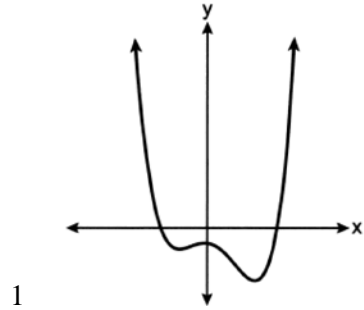
F.IF.B.4: GRAPHING POLYNOMIAL FUNCTIONS

- 121 Which graph has the following characteristics?

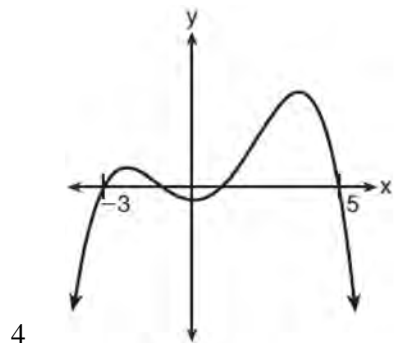
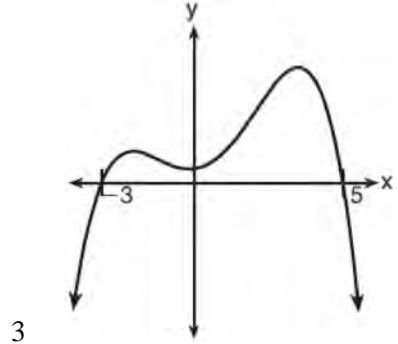
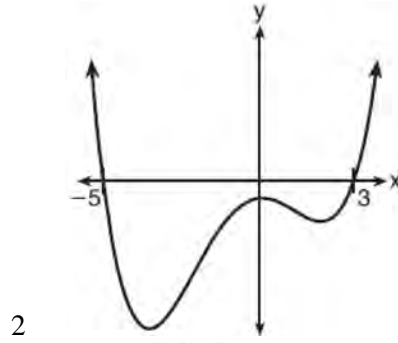
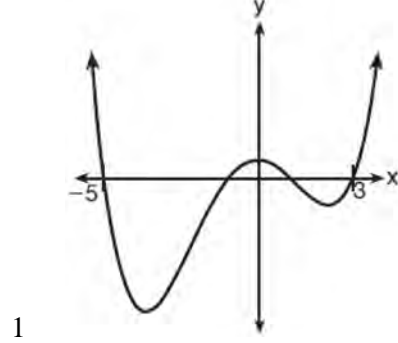
- three real zeros
- as $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$
- as $x \rightarrow \infty$, $f(x) \rightarrow \infty$



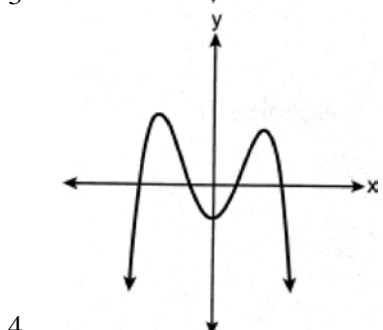
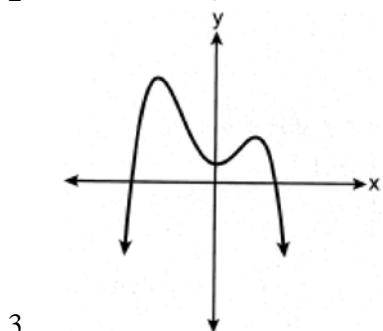
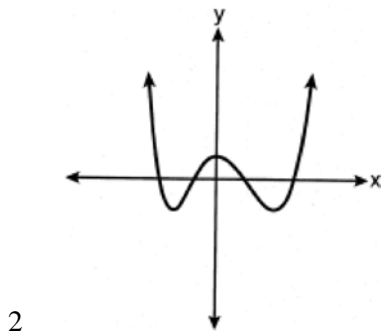
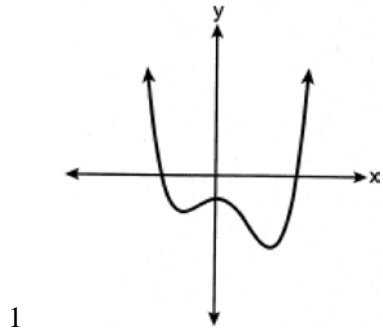
122 Which graph shows a fourth-degree polynomial function with exactly two imaginary roots?



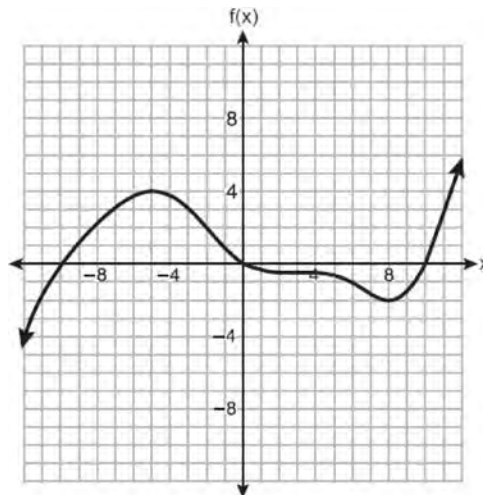
123 A 4th degree polynomial has zeros -5 , 3 , i , and $-i$. Which graph could represent the function defined by this polynomial?



124 Which graph could represent a 4th degree polynomial function with a positive leading coefficient, 2 real zeros, and 2 imaginary zeros?



125 The graph of the function $f(x)$ is shown below.



In which interval is $f(x)$ always positive?

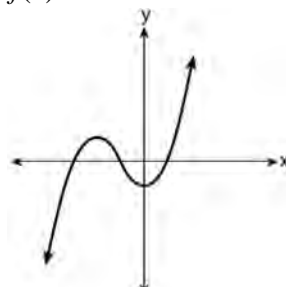
- 1 $(-2, 4)$
- 2 $(0, 10)$
- 3 $(-12, -5)$
- 4 $(-10, 0)$

126 Consider the end behavior description below.

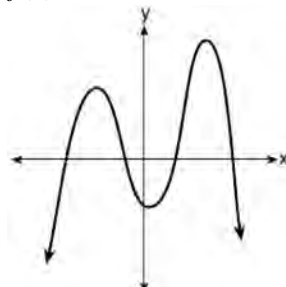
- as $x \rightarrow -\infty, f(x) \rightarrow \infty$
- as $x \rightarrow \infty, f(x) \rightarrow -\infty$

Which function satisfies the given conditions?

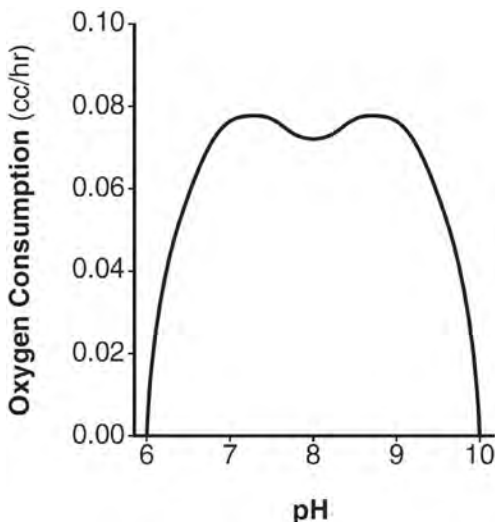
1 $f(x) = x^4 + 2x^2 + 1$



3 $f(x) = -x^3 + 2x - 6$



- 127 There was a study done on oxygen consumption of snails as a function of pH, and the result was a degree 4 polynomial function whose graph is shown below.



Which statement about this function is *incorrect*?

- 1 The degree of the polynomial is even.
 - 2 There is a positive leading coefficient.
 - 3 At two pH values, there is a relative maximum value.
 - 4 There are two intervals where the function is decreasing.
- 128 The average cost of a gallon of milk in the United States between the years of 1995 and 2018 can be modeled by the equation $P(t) = -0.0004t^3 + 0.0114t^2 - 0.0150t + 2.6602$, where $P(t)$ represents the cost, in dollars, and t is time in years since January 1995. During this time period, in what year did $P(t)$ reach its maximum?
- 1 1995
 - 2 2013
 - 3 2014
 - 4 2018

- 129 Consider a cubic polynomial with the characteristics below.

- exactly one real root
- as $x \rightarrow \infty, f(x) \rightarrow -\infty$

Given $a > 0$ and $b > 0$, which equation represents a cubic polynomial with these characteristics?

- 1 $f(x) = (x - a)(x^2 + b)$
 - 2 $f(x) = (a - x)(x^2 + b)$
 - 3 $f(x) = (a - x^2)(x^2 + b)$
 - 4 $f(x) = (x - a)(b - x^2)$
- 130 Which description could represent the graph of $f(x) = 4x^2(x + a) - x - a$, if a is an integer?
- 1 As $x \rightarrow -\infty, f(x) \rightarrow \infty$, as $x \rightarrow \infty, f(x) \rightarrow \infty$, and the graph has 3 x -intercepts.
 - 2 As $x \rightarrow -\infty, f(x) \rightarrow -\infty$, as $x \rightarrow \infty, f(x) \rightarrow \infty$, and the graph has 3 x -intercepts.
 - 3 As $x \rightarrow -\infty, f(x) \rightarrow \infty$, as $x \rightarrow \infty, f(x) \rightarrow -\infty$, and the graph has 4 x -intercepts.
 - 4 As $x \rightarrow -\infty, f(x) \rightarrow -\infty$, as $x \rightarrow \infty, f(x) \rightarrow \infty$, and the graph has 4 x -intercepts.

- 131 Given $f(x) = x^4 - x^3 - 6x^2$, for what values of x will $f(x) > 0$?

- 1 $x < -2$, only
- 2 $x < -2$ or $x > 3$
- 3 $x < -2$ or $0 \leq x \leq 3$
- 4 $x > 3$, only

- 132 An estimate of the number of milligrams of a medication in the bloodstream t hours after 400 mg has been taken can be modeled by the function below.

$$I(t) = 0.5t^4 + 3.45t^3 - 96.65t^2 + 347.7t,$$

where $0 \leq t \leq 6$

Over what time interval does the amount of medication in the bloodstream strictly increase?

- 1 0 to 2 hours
- 2 0 to 3 hours
- 3 2 to 6 hours
- 4 3 to 6 hours

- 133 The function below models the average price of gas in a small town since January 1st.

$$G(t) = -0.0049t^4 + 0.0923t^3 - 0.56t^2 + 1.166t + 3.23,$$

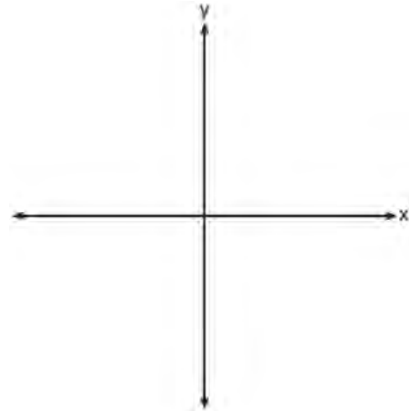
where $0 \leq t \leq 10$.

If $G(t)$ is the average price of gas in dollars and t represents the number of months since January 1st, the absolute maximum $G(t)$ reaches over the given domain is about

- 1 \$1.60
 - 2 \$3.92
 - 3 \$4.01
 - 4 \$7.73
- 134 A polynomial equation of degree three, $p(x)$, is used to model the volume of a rectangular box. The graph of $p(x)$ has x intercepts at -2 , 10 , and 14 . Which statements regarding $p(x)$ could be true?
- A. The equation of $p(x) = (x - 2)(x + 10)(x + 14)$.
 - B. The equation of $p(x) = -(x + 2)(x - 10)(x - 14)$.
 - C. The maximum volume occurs when $x = 10$.
 - D. The maximum volume of the box is approximately 56.
- 1 A and C
 - 2 A and D
 - 3 B and C
 - 4 B and D
- 135 Factor completely over the set of integers: $16x^4 - 81$. Sara graphed the polynomial $y = 16x^4 - 81$ and stated "All the roots of $y = 16x^4 - 81$ are real." Is Sara correct? Explain your reasoning.

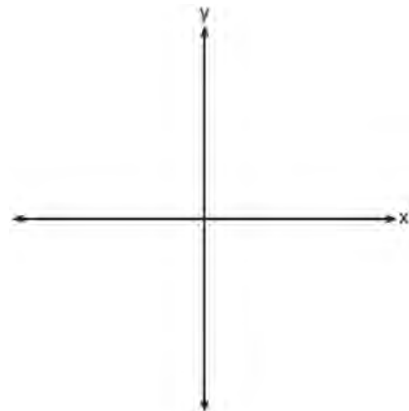
F.IF.C.7: GRAPHING POLYNOMIAL FUNCTIONS

- 136 The zeros of a quartic polynomial function are 2 , -2 , 4 , and -4 . Use the zeros to construct a possible sketch of the function, on the set of axes below.

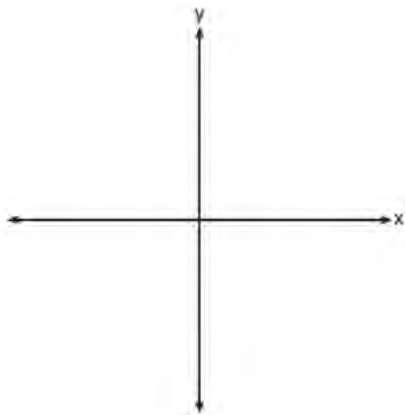


- 137 Sketch a graph of polynomial $P(x)$, given the criteria below:

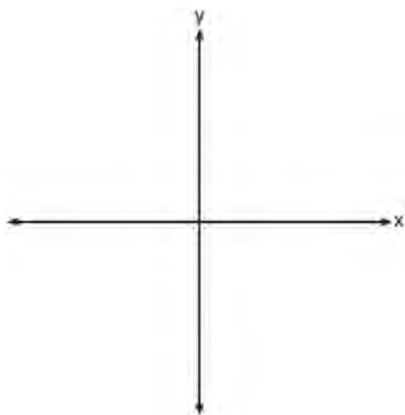
- $P(x)$ has zeros only at -5 , 1 , and 4
- As $x \rightarrow \infty, P(x) \rightarrow -\infty$
- As $x \rightarrow -\infty, P(x) \rightarrow -\infty$



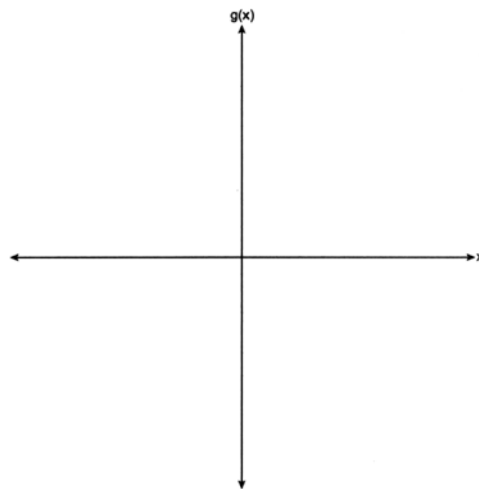
- 138 On the axes below, sketch a possible function $p(x) = (x - a)(x - b)(x + c)$, where a , b , and c are positive, $a > b$, and $p(x)$ has a positive y -intercept of d . Label all intercepts.



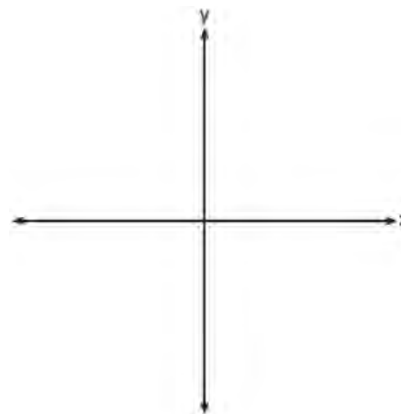
- 139 Patricia creates a cubic polynomial function, $p(x)$, with a leading coefficient of 1. The zeros of the function are 2, 3, and -6 . Write an equation for $p(x)$. Sketch $y = p(x)$ on the set of axes below.



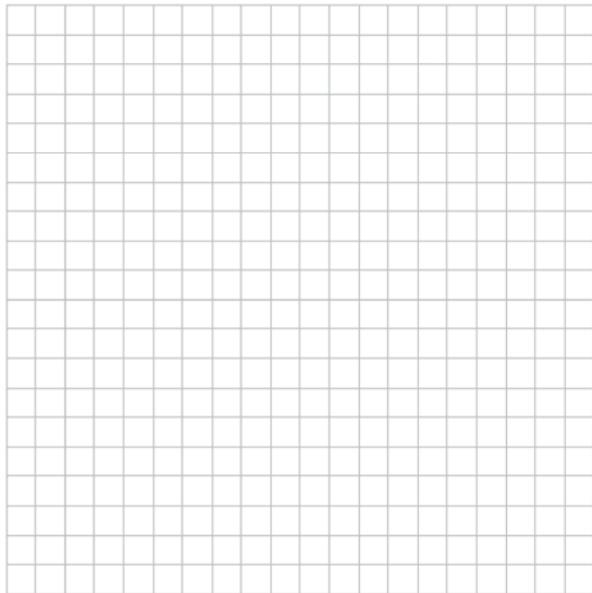
- 140 Sketch $g(x) = -x^3 - 7x^2 + 36$ on the axes below, including appropriate end behavior and zeros.



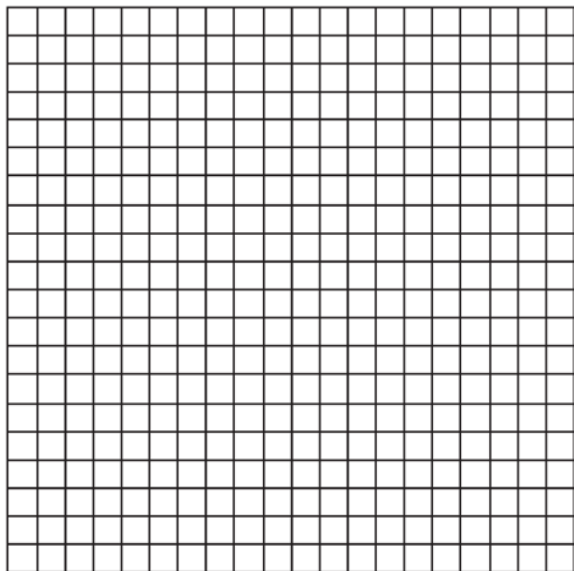
- 141 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$. On the axes below, sketch $y = c(x)$.



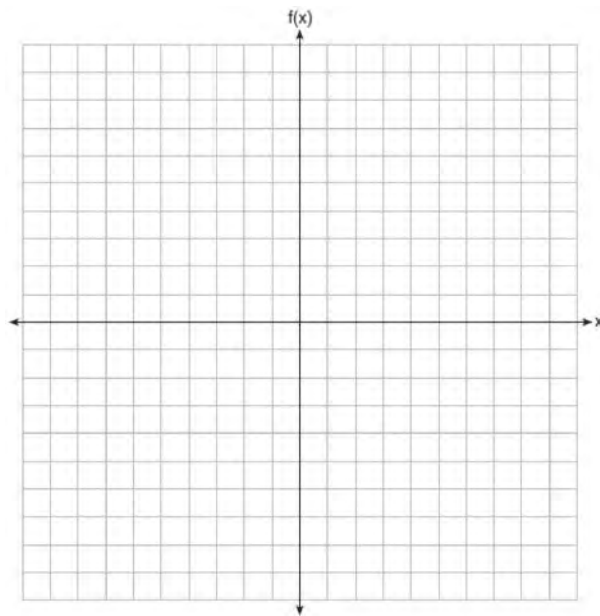
- 142 On the grid below, sketch a cubic polynomial whose zeros are 1, 3, and -2.



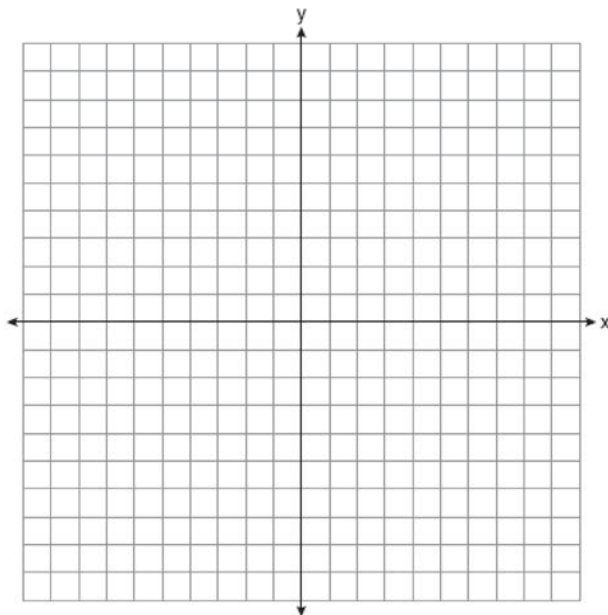
- 143 The zeros of a quartic polynomial function h are $-1, \pm 2,$ and 3 . Sketch a graph of $y = h(x)$ on the grid below.



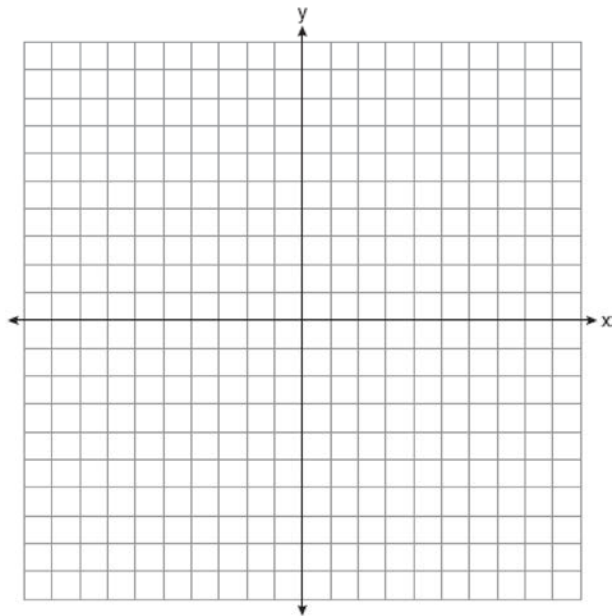
- 144 On the grid below, graph the function $f(x) = x^3 - 6x^2 + 9x + 6$ on the domain $-1 \leq x \leq 4$.



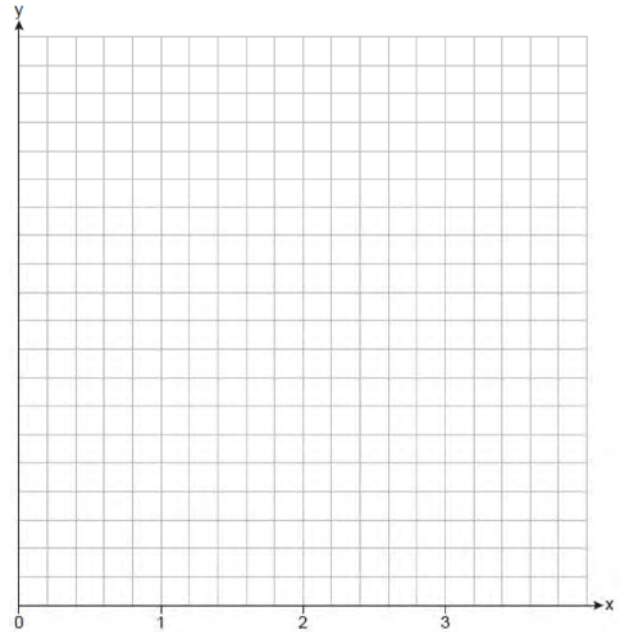
- 145 Graph $y = x^3 - 4x^2 + 2x + 7$ on the set of axes below.



- 146 Find algebraically the zeros for
 $p(x) = x^3 + x^2 - 4x - 4$. On the set of axes below,
graph $y = p(x)$.



- 147 The function $v(x) = x(3 - x)(x + 4)$ models the volume, in cubic inches, of a rectangular solid for $0 \leq x \leq 3$. Graph $y = v(x)$ over the domain $0 \leq x \leq 3$.

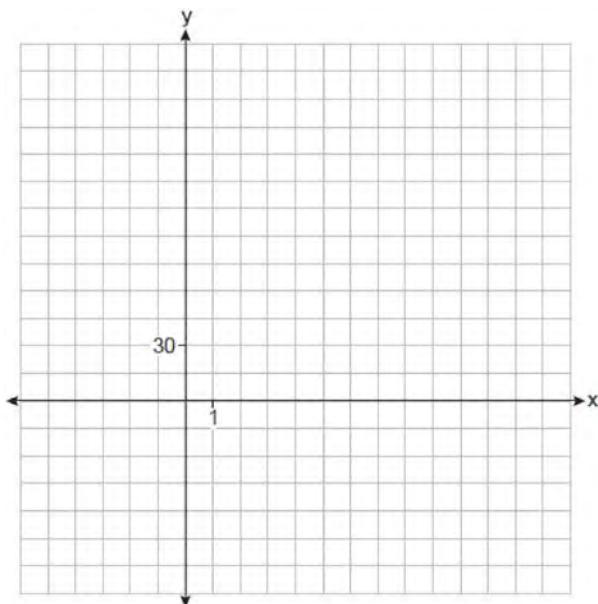


To the *nearest tenth of a cubic inch*, what is the maximum volume of the rectangular solid?

- 148 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit, $p(x)$, in thousands of dollars, as a function of the number of sweatshirts sold, x , in thousands. This function, p , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph $y = p(x)$, over the interval $0 \leq x \leq 9$, on the set of axes below.



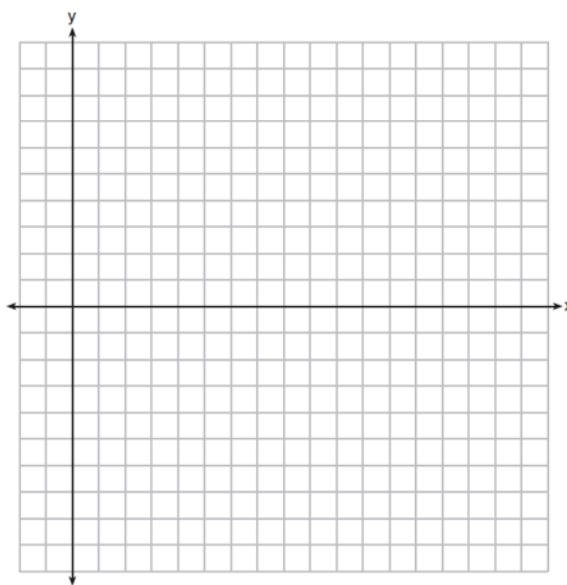
Over the given interval, state the coordinates of the maximum of p and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit. Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

- 149 A major car company analyzes its revenue, $R(x)$, and costs $C(x)$, in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years, x , using the given functions.

$$R(x) = 550x^3 - 12,000x^2 + 83,000x + 7000$$

$$C(x) = 880x^3 - 21,000x^2 + 150,000x - 160,000$$

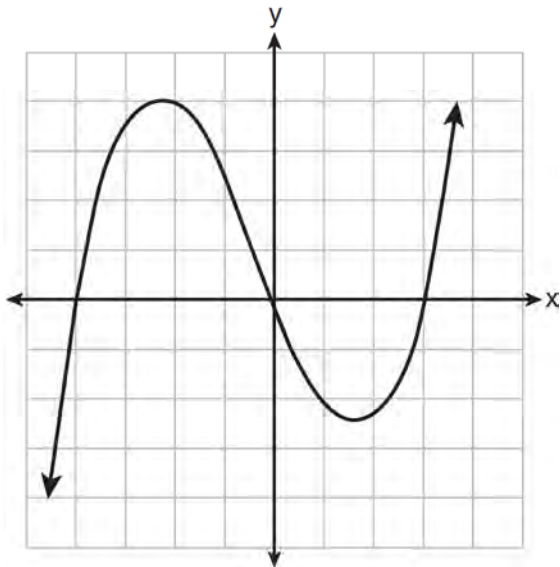
The company's profits can be represented as the difference between its revenue and costs. Write the profit function, $P(x)$, as a polynomial in standard form. Graph $y = P(x)$ on the set of axes below over the domain $2 \leq x \leq 16$.



Over the given domain, state when the company was the least profitable and the most profitable, to the *nearest year*. Explain how you determined your answer.

A.APR.B.2: REMAINDER AND FACTOR THEOREMS

150 The graph of $p(x)$ is shown below.



What is the remainder when $p(x)$ is divided by $x+4$?

- 1 $x-4$
 2 -4
 3 0
 4 4
- 151 Which binomial is a factor of $g^3 + 6g^2 + g - 14$?
- 1 $g-1$
 2 $g-2$
 3 $g+1$
 4 $g+2$
- 152 Which binomial is *not* a factor of the expression $x^3 - 11x^2 + 16x + 84$?
- 1 $x+2$
 2 $x+4$
 3 $x-6$
 4 $x-7$

- 153 Which expression is a factor of $x^4 - x^3 - 11x^2 + 5x + 30$?
- 1 $x+2$
 2 $x-2$
 3 $x+5$
 4 $x-5$
- 154 What is the remainder when $4x^3 - 3x + 3$ is divided by $x-2$?
- 1 -23
 2 -7
 3 13
 4 29
- 155 If $p(x) = 2x^3 - 3x + 5$, what is the remainder of $p(x) \div (x-5)$?
- 1 -230
 2 0
 3 40
 4 240
- 156 If $x-1$ is a factor of $x^3 - kx^2 + 2x$, what is the value of k ?
- 1 0
 2 2
 3 3
 4 -3
- 157 Which binomial is a factor of $x^4 - 4x^2 - 4x + 8$?
- 1 $x-2$
 2 $x+2$
 3 $x-4$
 4 $x+4$
- 158 If $x-5$ is a factor of $p(x) = ax^4 + bx^3 + cx^2 + dx + e$, then which statement must be true?
- 1 $p(-5) = 0$
 2 $p(-5) \neq 0$
 3 $p(5) = 0$
 4 $p(5) \neq 0$

- 159 Given $P(x) = x^3 - 3x^2 - 2x + 4$, which statement is true?
- 1 $(x - 1)$ is a factor because $P(-1) = 2$.
 - 2 $(x + 1)$ is a factor because $P(-1) = 2$.
 - 3 $(x + 1)$ is a factor because $P(1) = 0$.
 - 4 $(x - 1)$ is a factor because $P(1) = 0$.
- 160 Consider the function $f(x) = 2x^3 + x^2 - 18x - 9$. Which statement is true?
- 1 $2x - 1$ is a factor of $f(x)$.
 - 2 $x - 3$ is a factor of $f(x)$.
 - 3 $f(3) \neq f\left(-\frac{1}{2}\right)$
 - 4 $f\left(\frac{1}{2}\right) = 0$
- 161 For the polynomial $p(x)$, if $p(3) = 0$, it can be concluded that
- 1 $x + 3$ is a factor of $p(x)$
 - 2 $x - 3$ is a factor of $p(x)$
 - 3 when $p(x)$ is divided by 3, the remainder is zero
 - 4 when $p(x)$ is divided by -3 , the remainder is zero
- 162 When $g(x)$ is divided by $x + 4$, the remainder is 0. Given $g(x) = x^4 + 3x^3 - 6x^2 - 6x + 8$, which conclusion about $g(x)$ is true?
- 1 $g(4) = 0$
 - 2 $g(-4) = 0$
 - 3 $x - 4$ is a factor of $g(x)$.
 - 4 No conclusion can be made regarding $g(x)$.
- 163 If $f(x) = 2x^4 - x^3 - 16x + 8$, then $f\left(\frac{1}{2}\right)$
- 1 equals 0 and $2x + 1$ is a factor of $f(x)$
 - 2 equals 0 and $2x - 1$ is a factor of $f(x)$
 - 3 does not equal 0 and $2x + 1$ is not a factor of $f(x)$
 - 4 does not equal 0 and $2x - 1$ is a factor of $f(x)$
- 164 Which statements must be true about the polynomial function $k(x) = -2x^3 - 11x^2 - 12x + 9$?
- I. $(x - 3)$ is a factor of $k(x)$
 - II. $k(0) = 9$
 - III. $\frac{k(x)}{x + 2}$ has a remainder of 5
- 1 II, only
 - 2 I and II
 - 3 II and III
 - 4 I, II, and III
- 165 Show why $x - 3$ is a factor of $m(x) = x^3 - x^2 - 5x - 3$. Justify your answer.
- 166 Use an appropriate procedure to show that $x - 4$ is a factor of the function $f(x) = 2x^3 - 5x^2 - 11x - 4$. Explain your answer.
- 167 Determine if $x - 5$ is a factor of $2x^3 - 4x^2 - 7x - 10$. Explain your answer.
- 168 Determine if $x + 4$ is a factor of $2x^3 + 10x^2 + 4x - 16$. Explain your answer.
- 169 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$? Justify your answer.
- 170 Given $r(x) = x^3 - 4x^2 + 4x - 6$, find the value of $r(2)$. What does your answer tell you about $x - 2$ as a factor of $r(x)$? Explain.
- 171 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.
- $$P(x) = x^4 - 3x^3 - 16x - 12$$
- $$Q(x) = x^3 - 3x^2 - 16x - 12$$
- 172 The polynomial function $g(x) = x^3 + ax^2 - 5x + 6$ has a factor of $(x - 3)$. Determine the value of a .
- 173 Consider the function $f(x)$ below. Is $(x + 3)$ a factor of $f(x)$? Justify answer.
- $$f(x) = x^3 + 3x^2 - 2x - 6$$
- Determine all zeros of $f(x)$.

174 Evaluate $j(-1)$ given

$j(x) = 2x^4 - x^3 - 35x^2 + 16x + 48$. Explain what your answer tells you about $x + 1$ as a factor. Algebraically find the remaining zeros of $j(x)$.

N.RN.A.1: RADICALS AND RATIONAL EXPONENTS

175 Explain why $81^{\frac{3}{4}}$ equals 27.

176 Explain how $(-8)^{\frac{4}{3}}$ can be evaluated using properties of rational exponents to result in an integer answer.

177 Explain how $\left(3^{\frac{1}{5}}\right)^2$ can be written as the equivalent radical expression $\sqrt[5]{9}$.

178 Explain what a rational exponent, such as $\frac{5}{2}$ means.

Use this explanation to evaluate $9^{\frac{5}{2}}$.

N.RN.A.2: RADICALS AND RATIONAL EXPONENTS

179 For all positive values of x , which expression is equivalent to $x^{\frac{3}{4}}$?

- 1 $\sqrt[4]{x^3}$
- 2 $\sqrt[3]{x^4}$
- 3 $(x^3)^4$
- 4 $3(x^4)$

180 The expression $\sqrt[3]{16x^6}$ is equivalent to

- 1 $4x^3$
- 2 $4x^2$
- 3 $2x^2\sqrt[3]{2}$
- 4 $2x^3\sqrt[3]{2}$

181 The expression $8^{\frac{x}{2}} \cdot 8^{\frac{x}{3}}$ is equivalent to

- 1 $\sqrt[6]{8^{5x}}$
- 2 $64^{\frac{5x}{6}}$
- 3 $\sqrt[5]{8^{2x}}$
- 4 $64^{\frac{x^2}{6}}$

182 Which expression is equivalent to $2c^3\sqrt[3]{c}$?

- 1 $2c^{\frac{4}{3}}$
- 2 $2c^{\frac{3}{4}}$
- 3 $(2c)^{\frac{4}{3}}$
- 4 $(2c)^{\frac{3}{4}}$

183 Which expression is an equivalent form of $a^5\sqrt[4]{a^4}$?

- 1 a
- 2 $a^{\frac{9}{5}}$
- 3 $a^{\frac{9}{4}}$
- 4 $a^{\frac{1}{5}}$

184 Which expression is equivalent to $2xy^2\sqrt[3]{x^2y}$?

- 1 $2x^{\frac{5}{3}}y^{\frac{7}{3}}$
- 2 $2xy$
- 3 $2x^{\frac{2}{3}}y^{\frac{2}{3}}$
- 4 $2x^7y^4$

185 The expression $\sqrt[4]{81x^8y^6}$ is equivalent to

- 1 $3x^2y^{\frac{3}{2}}$
- 2 $3x^4y^2$
- 3 $9x^2y^{\frac{3}{2}}$
- 4 $9x^4y^2$

186 For all positive values of x , which expression is equivalent to $\sqrt{x} \cdot \sqrt[4]{x^{11}}$?

- 1 $x^{\frac{19}{22}}$
- 2 $x^{\frac{11}{8}}$
- 3 $x^{\frac{13}{4}}$
- 4 $x^{\frac{2}{11}}$

187 For $x > 0$, which expression is equivalent to $\sqrt[3]{9x^2} \cdot \sqrt{9x}$?

- 1 $9^5 x^{\frac{7}{2}}$
- 2 $9^6 x^3$
- 3 $9^{\frac{1}{6}} x^{\frac{1}{3}}$
- 4 $9^{\frac{5}{6}} x^{\frac{7}{6}}$

188 Given $x > 0$, the expression $\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}}$ can be rewritten as

- 1 $\sqrt[3]{x}$
- 2 $-\sqrt[10]{x^3}$
- 3 $\frac{1}{\sqrt[10]{x^3}}$
- 4 $\sqrt[3]{x^{10}}$

189 If $n = \sqrt{a^5}$ and $m = a$, where $a > 0$, an expression for $\frac{n}{m}$ could be

- 1 $a^{\frac{5}{2}}$
- 2 a^4
- 3 $\sqrt[3]{a^2}$
- 4 $\sqrt{a^3}$

190 Given $x > 0$, the expression $\left(\frac{1}{x^{-2}}\right)^{-\frac{3}{4}}$ is equivalent

to

- 1 $x\sqrt{x}$
- 2 $\frac{1}{x\sqrt{x}}$
- 3 $\sqrt[3]{x^2}$
- 4 $\frac{1}{\sqrt[3]{x^2}}$

191 The expression $\left(\frac{m^2}{m^{\frac{1}{3}}}\right)^{-\frac{1}{2}}$ is equivalent to

- 1 $-\sqrt[6]{m^5}$
- 2 $\frac{1}{\sqrt[6]{m^5}}$
- 3 $-m^5\sqrt{m}$
- 4 $\frac{1}{m^5\sqrt{m}}$

192 When $b > 0$ and d is a positive integer, the expression $(3b)^{\frac{2}{d}}$ is equivalent to

- 1 $\frac{1}{\left(\sqrt[d]{3b}\right)^2}$
- 2 $\left(\sqrt{3b}\right)^d$
- 3 $\frac{1}{\sqrt{3b^d}}$
- 4 $\left(\sqrt[d]{3b}\right)^2$

193 Which equation is equivalent to $P = 210x^{\frac{4}{3}}y^{\frac{7}{3}}$

- 1 $P = \sqrt[3]{210x^4y^7}$
- 2 $P = 70xy^2\sqrt[3]{xy}$
- 3 $P = 210xy^2\sqrt[3]{xy}$
- 4 $P = 210xy^2\sqrt[3]{x^3y^5}$

194 What does $\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}}$ equal?

- 1 $\frac{9ix^6\sqrt[3]{4}}{y\sqrt[3]{y^2}}$
- 2 $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 3 $\frac{9x^6\sqrt[3]{4}}{y\sqrt[3]{y}}$
- 4 $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

195 For $x > 0$, which expression is equivalent to $\frac{\sqrt[3]{x^2} \cdot \sqrt{x^5}}{\sqrt[6]{x}}$?

- 1 x
- 2 $x^{\frac{3}{2}}$
- 3 x^3
- 4 x^{10}

196 For $x \neq 0$, which expressions are equivalent to one divided by the sixth root of x ?

I. $\frac{\sqrt[6]{x}}{\sqrt[3]{x}}$ II. $\frac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}}$ III. $x^{\frac{-1}{6}}$

- 1 I and II, only
- 2 I and III, only
- 3 II and III, only
- 4 I, II, and III

197 Given x and y are positive, which expressions are equivalent to $\frac{x^3}{y}$?

I. $\left(\frac{y}{x^3}\right)^{-1}$ II. $\sqrt[3]{x^9}(y^{-1})$ III. $\frac{x^6\sqrt[4]{y^8}}{x^3y^3}$

- 1 I and II, only
- 2 I and III, only
- 3 II and III, only
- 4 I, II, and III

198 For $x \geq 0$, which equation is *false*?

- 1 $(x^{\frac{3}{2}})^2 = \sqrt[4]{x^3}$
- 2 $(x^3)^{\frac{1}{4}} = \sqrt[4]{x^3}$
- 3 $(x^{\frac{3}{2}})^{\frac{1}{2}} = \sqrt[4]{x^3}$
- 4 $(x^{\frac{2}{3}})^2 = \sqrt[3]{x^4}$

199 The expression $\left(a\sqrt[3]{2b^2}\right)\left(\sqrt[3]{4a^2b}\right)$ is equivalent to

- 1 $2ab\sqrt[3]{a^2}$
- 2 $2ab$
- 3 $2ab\sqrt[3]{2a^2}$
- 4 $2a^2b\sqrt[3]{2b}$

200 Given $y > 0$, the expression $\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2}$ is equivalent to

- 1 $81x^5y^3$
- 2 $3^{1.5}x^2y$
- 3 $3^{\frac{5}{2}}x^2y^{\frac{5}{3}}$
- 4 $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$

201 For positive values of x , which expression is

equivalent to $\sqrt{16x^2} \cdot x^{\frac{2}{3}} + \sqrt[3]{8x^5}$

- 1 $6\sqrt[5]{x^3}$
- 2 $6\sqrt[3]{x^5}$
- 3 $4\sqrt[3]{x^2} + 2\sqrt[3]{x^5}$
- 4 $4\sqrt{x^3} + 2\sqrt[5]{x^3}$

202 Write $\sqrt[3]{x} \cdot \sqrt{x}$ as a single term with a rational exponent.

203 Kenzie believes that for $x \geq 0$, the expression $(\sqrt[7]{x^2})(\sqrt[5]{x^3})$ is equivalent to $\sqrt[35]{x^6}$. Is she correct? Justify your response algebraically.

204 For n and $p > 0$, is the expression

$\left(p^2 n^{\frac{1}{2}}\right)^8 \sqrt{p^5 n^4}$ equivalent to $p^{18} n^6 \sqrt{p}$?

Justify your answer.

205 When $\left(\frac{1}{\sqrt[3]{y^2}}\right)^4$ is written in the form y^n , what is the value of n ? Justify your answer.

206 Write $\frac{x\sqrt{x^3}}{\sqrt[3]{x^5}}$ as a single term in simplest form, with a rational exponent.

207 Use the properties of rational exponents to determine the value of y for the equation:

$$\frac{\sqrt[3]{x^8}}{(x^4)^{\frac{1}{3}}} = x^y, x > 1$$

208 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

209 Justify why $\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents, where $x \neq 0$ and $y \neq 0$.

210 Express the fraction $\frac{2x^{\frac{3}{2}}}{(16x^4)^{\frac{1}{4}}}$ in simplest radical form.

211 For $x \neq 0$ and $y \neq 0$, $\sqrt[3]{81x^{15}y^9} = 3^a x^5 y^3$. Determine the value of a .

212 Given that $\left(\frac{y^{\frac{17}{8}}}{y^{\frac{5}{4}}}\right)^{-4} = y^n$, where $y > 0$, determine the value of n .

213 Given the equal terms $\sqrt[3]{x^5}$ and $y^{\frac{5}{6}}$, determine and state y , in terms of x .

A.REI.A.2: SOLVING RADICALS

214 The solution set for the equation $\sqrt{56-x} = x$ is

- 1 $\{-8, 7\}$
- 2 $\{-7, 8\}$
- 3 $\{7\}$
- 4 $\{\}$

Algebra II Regents Exam Questions by State Standard: Topic

215 What is the solution set of $x = \sqrt{3x + 40}$?

- 1 $\{-5, 8\}$
- 2 $\{8\}$
- 3 $\{-4, 10\}$
- 4 $\{ \}$

216 The solution set for the equation $\sqrt{3(x+6)} = x$ is

- 1 $\{6, -3\}$
- 2 $\{-6, 3\}$
- 3 $\{6\}$
- 4 $\{-3\}$

217 What is the solution set for x in the equation below?

$$\sqrt{x+1} - 1 = x$$

- 1 $\{1\}$
- 2 $\{0\}$
- 3 $\{-1, 0\}$
- 4 $\{0, 1\}$

218 The solution set of the equation $x - 1 = \sqrt{2x + 6}$ is

- 1 $\{5, -1\}$
- 2 $\{5\}$
- 3 $\{-1\}$
- 4 $\{ \}$

219 The solution set for the equation $x + 1 = \sqrt{4x + 25}$ is

- 1 $\{ \}$
- 2 $\{6\}$
- 3 $\{6, -4\}$
- 4 $\{-4\}$

220 The solution set for the equation $b = \sqrt{2b^2 - 64}$ is

- 1 $\{-8\}$
- 2 $\{8\}$
- 3 $\{\pm 8\}$
- 4 $\{ \}$

221 The value(s) of x that satisfy

$$\sqrt{x^2 - 4x - 5} = 2x - 10$$

- 1 $\{5\}$
- 2 $\{7\}$
- 3 $\{5, 7\}$
- 4 $\{3, 5, 7\}$

222 The solution set for the equation

$$\sqrt{x+14} - \sqrt{2x+5} = 1$$

- 1 $\{-6\}$
- 2 $\{2\}$
- 3 $\{18\}$
- 4 $\{2, 22\}$

223 Jin solved the equation $\sqrt{4-x} = x+8$ by squaring both sides. What extraneous solution did he find?

- 1 -5
- 2 -12
- 3 3
- 4 4

224 Determine the solution of $\sqrt{3x+7} = x-1$ algebraically.

225 Solve algebraically for all values of x :

$$\sqrt{4x+1} = 11-x$$

226 Algebraically determine the solution to the equation $\sqrt{x-2} + x = 4$.

227 Solve algebraically for all values of x :

$$\sqrt{x-4} + x = 6$$

228 Solve algebraically for all values of x :

$$\sqrt{x-5} + x = 7$$

229 Solve algebraically for all values of x :

$$\sqrt{x+5} - x = 3$$

230 Solve the equation $\sqrt{49-10x} + 5 = 2x$ algebraically.

Algebra II Regents Exam Questions by State Standard: Topic

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- 231 Solve algebraically for all values of x :

$$\sqrt{6-2x} + x = 2(x+15) - 9$$

- 232 Algebraically solve for x : $2x = 6 + 2\sqrt{x-1}$

- 233 Solve the given equation algebraically for all values of x . $3\sqrt{x} - 2x = -5$

- 234 Solve the equation $\sqrt{2x-7} + x = 5$ algebraically, and justify the solution set.

- 235 The speed of a tidal wave, s , in hundreds of miles per hour, can be modeled by the equation

$s = \sqrt{t} - 2t + 6$, where t represents the time from its origin in hours. Algebraically determine the time when $s = 0$. How much faster was the tidal wave traveling after 1 hour than 3 hours, to the nearest mile per hour? Justify your answer.

- 237 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B , are determined by the equation

$B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

- 236 A Foucault pendulum can be used to demonstrate that the Earth rotates. The time, t , in seconds, that it takes for one swing or period of the pendulum

can be modeled by the equation $t = 2\pi\sqrt{\frac{L}{g}}$ where

L is the length of the pendulum in meters and g is a constant of 9.81 m/s^2 . The first Foucault pendulum was constructed in 1851 and has a pendulum length of 67 m. Determine, to the nearest tenth of a second, the time it takes this pendulum to complete one swing. Another Foucault pendulum at the United Nations building takes 9.6 seconds to complete one swing. Determine, to the nearest tenth of a meter, the length of this pendulum.

Beaufort Wind Scale	
Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer. In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s , to the nearest mph. Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the nearest mph, associated with a Beaufort number of 10.

POWERS

A.SSE.B.3: MODELING EXPONENTIAL FUNCTIONS

- 238 Tim deposits \$300 into a savings account. The annual interest rate is 2.7% and compounds monthly. He uses the equation

$$A = 300 \left(1 + \frac{0.027}{12} \right)^{12t} \text{ to determine how much}$$

money he will have after t years. Which equation is equivalent to Tim's equation?

1 $A = 300 \left[(1.00225)^{12} \right]^t$

2 $A = 300(0.08558)^{12t}$

3 $A = 300 \left[1 + \left(\frac{0.027}{12} \right)^{12t} \right]$

4 $A = (300)^{12t} (1)^{12t} + \left(\frac{0.027}{12} \right)^{12t}$

- 239 Stephanie found that the number of white-winged cross bills in an area can be represented by the formula $C = 550(1.08)^t$, where t represents the number of years since 2010. Which equation correctly represents the number of white-winged cross bills in terms of the monthly rate of population growth?

1 $C = 550(1.00643)^t$

2 $C = 550(1.00643)^{12t}$

3 $C = 550(1.00643)^{\frac{t}{12}}$

4 $C = 550(1.00643)^{t+12}$

- 240 A study of the annual population of the red-winged blackbird in Ft. Mill, South Carolina, shows the population, $B(t)$, can be represented by the function $B(t) = 750(1.16)^t$, where the t represents the number of years since the study began. In terms of the monthly rate of growth, the population of red-winged blackbirds can be best approximated by the function

1 $B(t) = 750(1.012)^t$

2 $B(t) = 750(1.012)^{12t}$

3 $B(t) = 750(1.16)^{12t}$

4 $B(t) = 750(1.16)^{\frac{t}{12}}$

- 241 A study of the red tailed hawk population in a given area shows the population, $H(t)$, can be represented by the function $H(t) = 50(1.19)^t$ where t represents the number of years since the study began. In terms of the monthly rate of growth, the population can be best approximated by the function

1 $H(t) = 50(1.015)^{12t}$

2 $H(t) = 50(1.15)^{\frac{t}{12}}$

3 $H(t) = 50(1.19)^{12t}$

4 $H(t) = 50(1.19)^{\frac{t}{12}}$

- 242 A study of black bears in the Adirondacks reveals that their population can be represented by the function $P(t) = 3500(1.025)^t$, where t is the number of years since the study began. Which function is correctly rewritten to reveal the monthly growth rate of the black bear population?

1 $P(t) = 3500(1.00206)^{12t}$

2 $P(t) = 3500(1.00206)^{\frac{t}{12}}$

3 $P(t) = 3500(1.34489)^{12t}$

4 $P(t) = 3500(1.34489)^{\frac{t}{12}}$

- 243 The growth of a \$500 investment can be modeled by the function $P(t) = 500(1.03)^t$, where t represents time in years. In terms of the monthly rate of growth, the value of the investment can be best approximated by
- 1 $P(t) = 500(1.00247)^{12t}$
 - 2 $P(t) = 500(1.00247)^t$
 - 3 $P(t) = 500(1.03)^{12t}$
 - 4 $P(t) = 500(1.03)^{\frac{t}{12}}$
- 244 Julia deposits \$2000 into a savings account that earns 4% interest per year. The exponential function that models this savings account is $y = 2000(1.04)^t$, where t is the time in years. Which equation correctly represents the amount of money in her savings account in terms of the monthly growth rate?
- 1 $y = 166.67(1.04)^{0.12t}$
 - 2 $y = 2000(1.01)^t$
 - 3 $y = 2000(1.0032737)^{12t}$
 - 4 $y = 166.67(1.0032737)^t$
- 245 Mia has a student loan that is in deferment, meaning that she does not need to make payments right now. The balance of her loan account during her deferment can be represented by the function $f(x) = 35,000(1.0325)^x$, where x is the number of years since the deferment began. If the bank decides to calculate her balance showing a monthly growth rate, an approximately equivalent function would be
- 1 $f(x) = 35,000(1.0027)^{12x}$
 - 2 $f(x) = 35,000(1.0027)^{\frac{x}{12}}$
 - 3 $f(x) = 35,000(1.0325)^{12x}$
 - 4 $f(x) = 35,000(1.0325)^{\frac{x}{12}}$
- 246 Last year, the total revenue for Home Style, a national restaurant chain, increased 5.25% over the previous year. If this trend were to continue, which expression could the company's chief financial officer use to approximate their monthly percent increase in revenue? [Let m represent months.]
- 1 $(1.0525)^m$
 - 2 $(1.0525)^{\frac{12}{m}}$
 - 3 $(1.00427)^m$
 - 4 $(1.00427)^{\frac{m}{12}}$
- 247 Camryn puts \$400 into a savings account that earns 6% annually. The amount in her account can be modeled by $C(t) = 400(1.06)^t$ where t is the time in years. Which expression best approximates the amount of money in her account using a weekly growth rate?
- 1 $400(1.001153846)^t$
 - 2 $400(1.001121184)^t$
 - 3 $400(1.001153846)^{52t}$
 - 4 $400(1.001121184)^{52t}$
- 248 The number of people who have read an article grows exponentially throughout the day and can be modeled by the function $N(t) = 2(1.0098)^t$, where t represents the number of minutes since the article has been posted. Which equation best represents the number of people who have read the article in terms of the growth rate per second?
- 1 $N(t) = 2(1.000163)^{\frac{t}{60}}$
 - 2 $N(t) = 2(1.000163)^{60t}$
 - 3 $N(t) = 2(1.79524)^{\frac{t}{60}}$
 - 4 $N(t) = 2(1.79524)^{60t}$

- 249 A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model $P = 714(0.75)^d$, where P is the population, in thousands, d decades after 2010. Another student, Suzanne, wants to use a model that would predict the population after y years. Suzanne's model is best represented by
- 1 $P = 714(0.6500)^y$
 - 2 $P = 714(0.8500)^y$
 - 3 $P = 714(0.9716)^y$
 - 4 $P = 714(0.9750)^y$
- 250 According to the USGS, an agency within the Department of Interior of the United States, the frog population in the U.S. is decreasing at the rate of 3.79% per year. A student created a model, $P = 12,150(0.962)^t$, to estimate the population in a pond after t years. The student then created a model that would predict the population after d decades. This model is best represented by
- 1 $P = 12,150(0.461)^d$
 - 2 $P = 12,150(0.679)^d$
 - 3 $P = 12,150(0.996)^d$
 - 4 $P = 12,150(0.998)^d$
- 251 On average, college seniors graduating in 2012 could compute their growing student loan debt using the function $D(t) = 29,400(1.068)^t$, where t is time in years. Which expression is equivalent to $29,400(1.068)^t$ and could be used by students to identify an approximate daily interest rate on their loans?
- 1 $29,400 \left(1.068^{\frac{1}{365}} \right)^t$
 - 2 $29,400 \left(\frac{1.068}{365} \right)^{365t}$
 - 3 $29,400 \left(1 + \frac{0.068}{365} \right)^t$
 - 4 $29,400 \left(1.068^{\frac{1}{365}} \right)^{365t}$
- 252 To prepare for lacrosse tryouts, Kole is increasing the amount of time he spends at the gym. This week he is spending 150 minutes there and he plans to increase this amount by 2% each week. The amount of time, in minutes, that he plans to spend at the gym t weeks from now is given by the function $A(t) = 150(1.02)^t$. In terms of a daily growth rate, the amount of time Kole is planning to spend at the gym can best be modeled by the function
- 1 $A(t) = 150(1.14869)^{\frac{t}{7}}$
 - 2 $A(t) = 150(1.14869)^{7t}$
 - 3 $A(t) = 150(1.00283)^{\frac{t}{7}}$
 - 4 $A(t) = 150(1.00283)^{7t}$

- 253 The black bear population for a certain area of the Adirondacks can be modeled by the equation $B = 5835.943(1.026)^t$, where t is measured in years since 2010. Kieran would like to rewrite this model in terms of a 5-year growth rate. Kieran's model is best represented by

- 1 $B = 5835.943(1.005147)^{\frac{t}{5}}$
- 2 $B = 5835.943(1.005147)^{5t}$
- 3 $B = 5835.943(1.136938)^{\frac{t}{5}}$
- 4 $B = 5835.943(1.136938)^{5t}$

- 254 The amount of a substance, $A(t)$, that remains after t days can be given by the equation

$A(t) = A_0(0.5)^{\frac{t}{0.0803}}$, where A_0 represents the initial amount of the substance. An equivalent form of this equation is

- 1 $A(t) = A_0(0.000178)^t$
- 2 $A(t) = A_0(0.945861)^t$
- 3 $A(t) = A_0(0.04015)^t$
- 4 $A(t) = A_0(1.08361)^t$

- 255 Iridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams, A , of Iridium-192 present after t days

would be $A = 100\left(\frac{1}{2}\right)^{\frac{t}{73.83}}$. Which equation

approximates the amount of Iridium-192 present after t days?

- 1 $A = 100\left(\frac{73.83}{2}\right)^t$
- 2 $A = 100\left(\frac{1}{147.66}\right)^t$
- 3 $A = 100(0.990656)^t$
- 4 $A = 100(0.116381)^t$

- 256 Luminescence is the emission of light that is not caused by heat. A luminescent substance decays according to the function below.

$$I = I_0 e^{3\left(-\frac{t}{0.6}\right)}$$

This function can be best approximated by

- 1 $I = I_0 e^{\left(-\frac{t}{0.18}\right)}$
- 2 $I = I_0 e^{5t}$
- 3 $I = I_0(0.0067)^t$
- 4 $I = I_0(0.0497)^{0.6t}$

- 257 Kelly-Ann has \$20,000 to invest. She puts half of the money into an account that grows at an annual rate of 0.9% compounded monthly. At the same time, she puts the other half of the money into an account that grows continuously at an annual rate of 0.8%. Which function represents the value of Kelly-Ann's investments after t years?

- 1 $f(t) = 10,000(1.9)^t + 10,000e^{0.8t}$
- 2 $f(t) = 10,000(1.009)^t + 10,000e^{0.008t}$
- 3 $f(t) = 10,000(1.075)^{12t} + 10,000e^{0.8t}$
- 4 $f(t) = 10,000(1.00075)^{12t} + 10,000e^{0.008t}$

- 258 For a given time, x , in seconds, an electric current, y , can be represented by $y = 2.5\left(1 - 2.7^{-10x}\right)$.

Which equation is *not* equivalent?

- 1 $y = 2.5 - 2.5\left(2.7^{-10x}\right)$
- 2 $y = 2.5 - 2.5\left(\left(2.7^2\right)^{-0.5x}\right)$
- 3 $y = 2.5 - 2.5\left(\frac{1}{2.7^{10x}}\right)$
- 4 $y = 2.5 - 2.5\left(2.7^{-2}\right)\left(2.7^{0.5x}\right)$

- 259 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function

$V(x) = 33,400(0.85)^x$, where x represents the years since purchase. Julia and Jacob have each written a function that is equivalent to the original.

Jacob's function: $V(x) = 33,400(0.1422)^{\frac{1}{12}x}$

Julia's function: $V(x) = 33,400(0.9865)^{12x}$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

F.BF.A.1: MODELING EXPONENTIAL FUNCTIONS

- 260 The element Americium has a half-life of 25 minutes. Given an initial amount, A_0 , which expression could be used to determine the amount of Americium remaining after t minutes?

1 $A_0 \left(\frac{1}{2} \right)^{\frac{t}{25}}$

2 $A_0(25)^{\frac{t}{2}}$

3 $25 \left(\frac{1}{2} \right)^t$

4 $A_0 \left(\frac{1}{2} \right)^{25t}$

- 261 A culture of 1000 bacteria triples every 10 hours. Which expression models the number of bacteria in the sample after t hours?

1 $1000e^{3t}$

2 $1000(3)^t$

3 $1000(3)^{10t}$

4 $1000(3)^{\frac{t}{10}}$

- 262 Susan won \$2,000 and invested it into an account with an annual interest rate of 3.2%. If her investment were compounded monthly, which expression best represents the value of her investment after t years?

1 $2000(1.003)^{12t}$

2 $2000(1.032)^{\frac{t}{12}}$

3 $2064^{\frac{t}{12}}$

4 $\frac{2000(1.032)^t}{12}$

- 263 A payday loan company makes loans between \$100 and \$1000 available to customers. Every 14 days, customers are charged 30% interest with compounding. In 2013, Remi took out a \$300 payday loan. Which expression can be used to calculate the amount she would owe, in dollars, after one year if she did not make payments?

1 $300(.30)^{\frac{14}{365}}$

2 $300(1.30)^{\frac{14}{365}}$

3 $300(.30)^{\frac{365}{14}}$

4 $300(1.30)^{\frac{365}{14}}$

- 264 According to a pricing website, Indroid phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a \$300 Indroid phone in 1.5 years?

1 $300e^{-0.87}$

2 $300e^{-0.63}$

3 $300e^{-0.58}$

4 $300e^{-0.42}$

- 265 Audra is interested in studying the number of students entering kindergarten in the Ahlville Central School District over the next several years. Using data dating back to 2015, she determines that the number of kindergarteners is decreasing at an exponential rate. She creates a formula to model this situation $y = a(b)^x$, where x is the number of years since 2015 and y is the number of students entering kindergarten. If there were 105 students entering kindergarten in Ahlville in 2015, which statement about Audra's formula is true?
- 1 a is positive and b is negative.
 - 2 a is negative and b is positive.
 - 3 Both a and b are positive.
 - 4 Both a and b are negative.
- 266 Biologists are studying a new bacterium. They create a culture with 100 of the bacteria and anticipate that the number of bacteria will double every 30 hours. Write an equation for the number of bacteria, B , in terms of the number of hours, t , since the experiment began.
- 267 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

F.LE.A.2: MODELING EXPONENTIAL EQUATIONS

- 268 Sodium iodide-131, used to treat certain medical conditions, has a half-life of 1.8 hours. The data table below shows the amount of sodium iodide-131, rounded to the nearest thousandth, as the dose fades over time.

Number of Half Lives	1	2	3	4	5
Amount of Sodium Iodide-131	139.000	69.500	34.750	17.375	8.688

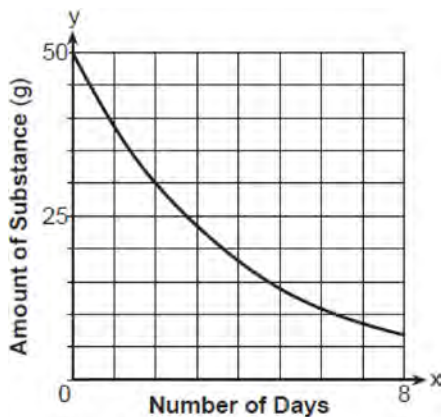
What approximate amount of sodium iodide-131 will remain in the body after 18 hours?

- | | |
|---------|---------|
| 1 0.001 | 3 0.271 |
| 2 0.136 | 4 0.543 |
- 269 A rabbit population doubles every 4 weeks. There are currently five rabbits in a restricted area. If t represents the time, in weeks, and $P(t)$ is the population of rabbits with respect to time, about how many rabbits will there be in 98 days?
- 1 56
 - 2 152
 - 3 3688
 - 4 81,920
- 270 If \$5000 is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the *nearest ten cents*, would be in that account after 6 years, assuming no money was added or withdrawn?
- 1 \$5177.80
 - 2 \$5941.30
 - 3 \$6146.30
 - 4 \$6166.50
- 271 A population of 950 bacteria grows continuously at a rate of 4.75% per day. Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base. Determine the bacterial population after 36 hours, to the *nearest bacterium*.

- 272 Titanium-44 is a radioactive isotope such that every 63 years, its mass decreases by half. For a sample of titanium-44 with an initial mass of 100 grams, write a function that will give the mass of the sample remaining after any amount of time. Define all variables. Scientists sometimes use the average yearly decrease in mass for estimation purposes. Use the average yearly decrease in mass of the sample between year 0 and year 10 to predict the amount of the sample remaining after 40 years. Round your answer to the *nearest tenth*. Is the actual mass of the sample or the estimated mass greater after 40 years? Justify your answer.

F.LE.B.5: MODELING EXPONENTIAL EQUATIONS

- 273 The graph below shows the amount of a radioactive substance left over time.



The daily rate of decay over an 8-day interval is approximately

- 1 23%
 - 2 95%
 - 3 5%
 - 4 77%
- 274 The value of an automobile t years after it was purchased is given by the function $V = 38,000(0.84)^t$. Which statement is true?
- 1 The value of the car increases 84% each year.
 - 2 The value of the car decreases 84% each year.
 - 3 The value of the car increases 16% each year.
 - 4 The value of the car decreases 16% each year.

- 275 The function $P(t) = 256,485(0.965)^t$ models the decreasing population of a city from 1999 to 2014, where t is the time in years since 1999. Which statement is *not* true?
- 1 The function estimated the population was 256,485 in 1999.
 - 2 The decay rate was 0.35%.
 - 3 The decay factor is 0.965.
 - 4 The population declined over 15 years.

- 276 A certain pain reliever is taken in 220 mg dosages and has a half-life of 12 hours. The function

$$A = 220\left(\frac{1}{2}\right)^{\frac{t}{12}}$$

can be used to model this situation,

where A is the amount of pain reliever in milligrams remaining in the body after t hours. According to this function, which statement is true?

- 1 Every hour, the amount of pain reliever remaining is cut in half.
 - 2 In 12 hours, there is no pain reliever remaining in the body.
 - 3 In 24 hours, there is no pain reliever remaining in the body.
 - 4 In 12 hours, 110 mg of pain reliever is remaining.
- 277 The amount of a substance, $A(t)$, in grams, remaining after t days is modeled by

$$A(t) = 50(0.5)^{\frac{t}{3}}$$

Which statement is false?

- 1 In 20 days, there is no substance remaining.
- 2 After two half-lives, there is 25% of the substance remaining.
- 3 The amount of the substance remaining can also be modeled by $A(t) = 50(2)^{\frac{-t}{3}}$.
- 4 After one week, there is less than 10g of the substance remaining.

- 278 An equation to represent the value of a car after t months of ownership is $v = 32,000(0.81)^{\frac{t}{12}}$. Which statement is *not* correct?
- 1 The car lost approximately 19% of its value each month.
 - 2 The car maintained approximately 98% of its value each month.
 - 3 The value of the car when it was purchased was \$32,000.
 - 4 The value of the car 1 year after it was purchased was \$25,920.

- 279 If $f(t) = 50(.5)^{\frac{t}{5715}}$ represents a mass, in grams, of carbon-14 remaining after t years, which statement(s) must be true?
- I. The mass of the carbon-14 is decreasing by half each year.
 - II. The mass of the original sample is 50 g.
- 1 I, only
 - 2 II, only
 - 3 I and II
 - 4 neither I nor II

- 280 The function $p(t) = 110e^{0.03922t}$ models the population of a city, in millions, t years after 2010. As of today, consider the following two statements:
- I. The current population is 110 million.
 - II. The population increases continuously by approximately 3.9% per year.
- This model supports
- 1 I, only
 - 2 II, only
 - 3 both I and II
 - 4 neither I nor II

- 281 Given $E(t) = 26(2)^{\frac{t}{20}}$ represents the mass, in grams, of a substance after t minutes in a laboratory, which statement or statements must be true?
- I. The initial mass of the substance is 26 grams.
 - II. The mass of the substance doubles every 20 days.
 - III. The mass of the substance after 3 hours is approximately 29 grams.
- 1 I, only
 - 2 III, only
 - 3 I and II, only
 - 4 I and III, only

- 282 A savings account, S , has an initial value of \$50. The account grows at a 2% interest rate compounded n times per year, t , according to the function below.

$$S(t) = 50 \left(1 + \frac{.02}{n} \right)^{nt}$$

- Which statement about the account is correct?
- 1 As the value of n increases, the amount of interest per year decreases.
 - 2 As the value of n increases, the value of the account approaches the function $S(t) = 50e^{0.02t}$.
 - 3 As the value of n decreases to one, the amount of interest per year increases.
 - 4 As the value of n decreases to one, the value of the account approaches the function $S(t) = 50(1 - 0.02)^t$.

F.IF.B.4: EVALUATING EXPONENTIAL EXPRESSIONS

- 283 Robert is buying a car that costs \$22,000. After a down payment of \$4000, he borrows the remainder from a bank, a six year loan at 6.24% annual interest rate. The following formula can be used to calculate his monthly loan payment.

$$R = \frac{(P)(i)}{1 - (1 + i)^{-t}}$$

R = monthly payment
 P = loan amount
 i = monthly interest rate
 t = time, in months

Robert's monthly payment will be

- 1 \$298.31
 - 2 \$300.36
 - 3 \$307.35
 - 4 \$367.10
- 284 The George family would like to borrow \$45,000 to purchase a new boat. They qualified for a loan with an annual interest rate of 6.75%. The monthly loan payment can be found using the formula below.

$$M = \frac{P \left(\frac{r}{12} \right) \left(1 + \frac{r}{12} \right)^n}{\left(1 + \frac{r}{12} \right)^n - 1}$$

M = monthly payment
 P = amount borrowed
 r = annual interest rate
 n = number of monthly payments

What is the monthly payment if they would like to pay off the loan in five years?

- 1 \$262.99
- 2 \$252.13
- 3 \$915.24
- 4 \$885.76

- 285 Monthly mortgage payments can be found using the formula below, where M is the monthly payment, P is the amount borrowed, r is the annual interest rate, and n is the total number of monthly payments.

$$M = \frac{P \left(\frac{r}{12} \right) \left(1 + \frac{r}{12} \right)^n}{\left(1 + \frac{r}{12} \right)^n - 1}$$

If Adam takes out a 15-year mortgage, borrowing \$240,000 at an annual interest rate of 4.5%, his monthly payment will be

- 1 \$1379.09
- 2 \$1604.80
- 3 \$1835.98
- 4 \$9011.94

- 286 The Wells family is looking to purchase a home in a suburb of Rochester with a 30-year mortgage that has an annual interest rate of 3.6%. The house the family wants to purchase is \$152,500 and they will make a \$15,250 down payment and borrow the remainder. Use the formula below to determine their monthly payment, to the *nearest dollar*.

$$M = \frac{P \left(\frac{r}{12} \right) \left(1 + \frac{r}{12} \right)^n}{\left(1 + \frac{r}{12} \right)^n - 1}$$

M = monthly payment
 P = amount borrowed
 r = annual interest rate
 n = total number of monthly payments

- 287 Using the formula below, determine the monthly payment on a 5-year car loan with a monthly percentage rate of 0.625% for a car with an original cost of \$21,000 and a \$1000 down payment, to the nearest cent.

$$P_n = PMT \left(\frac{1 - (1 + i)^{-n}}{i} \right)$$

P_n = present amount borrowed

n = number of monthly pay periods

PMT = monthly payment

i = interest rate per month

The affordable monthly payment is \$300 for the same time period. Determine an appropriate down payment, to the nearest dollar.

- 288 Jim is looking to buy a vacation home for \$172,600 near his favorite southern beach. The formula to compute a mortgage payment, M , is

$$M = P \cdot \frac{r(1+r)^N}{(1+r)^N - 1}$$

where P is the principal

amount of the loan, r is the monthly interest rate, and N is the number of monthly payments. Jim's bank offers a monthly interest rate of 0.305% for a 15-year mortgage. With no down payment, determine Jim's mortgage payment, rounded to the nearest dollar. Algebraically determine and state the down payment, rounded to the nearest dollar, that Jim needs to make in order for his mortgage payment to be \$1100.

- 289 The temperature, F , in degrees Fahrenheit, after t hours of a roast put into an oven is given by the equation $F = 325 - 185e^{-0.4t}$. What was the temperature of the roast when it was put into the oven?

- 1 325
- 2 200
- 3 185
- 4 140

F.IF.B.4: EVALUATING LOGARITHMIC EXPRESSIONS

- 290 The loudness of sound is measured in units called decibels (dB). These units are measured by first assigning an intensity I_0 to a very soft sound that is called the threshold sound. The sound to be measured is assigned an intensity, I , and the decibel rating, d , of this sound is found using $d = 10 \log \frac{I}{I_0}$. The threshold sound audible to the average person is 1.0×10^{-12} W/m² (watts per square meter). Consider the following sound level classifications:

Moderate	45-69 dB
Loud	70-89 dB
Very loud	90-109 dB
Deafening	>110 dB

How would a sound with intensity 6.3×10^{-3} W/m² be classified?

- | | |
|------------|-------------|
| 1 moderate | 3 very loud |
| 2 loud | 4 deafening |

F.IF.C.7: GRAPHING EXPONENTIAL FUNCTIONS

291 If the function $g(x) = ab^x$ represents exponential growth, which statement about $g(x)$ is *false*?

- 1 $a > 0$ and $b > 1$
- 2 The y -intercept is $(0, a)$.
- 3 The asymptote is $y = 0$.
- 4 The x -intercept is $(b, 0)$.

292 The graph of $y = 2^x - 4$ is positive on which interval?

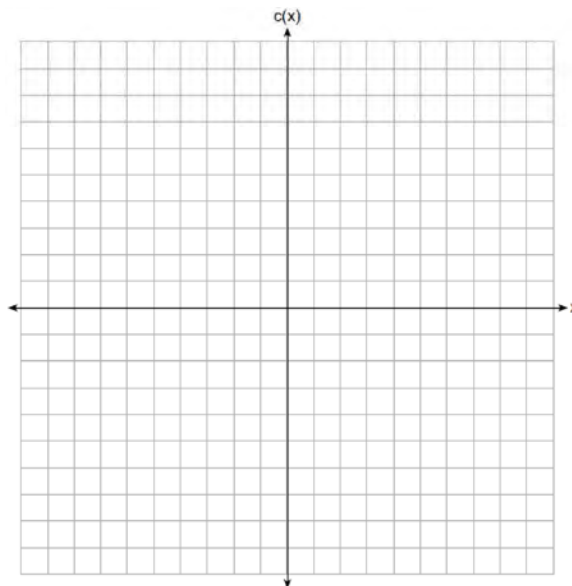
- 1 $(-\infty, \infty)$
- 2 $(2, \infty)$
- 3 $(0, \infty)$
- 4 $(-4, \infty)$

293 Given $f(x) = 3^{x-1} + 2$, as $x \rightarrow -\infty$

- 1 $f(x) \rightarrow -1$
- 2 $f(x) \rightarrow 0$
- 3 $f(x) \rightarrow 2$
- 4 $f(x) \rightarrow -\infty$

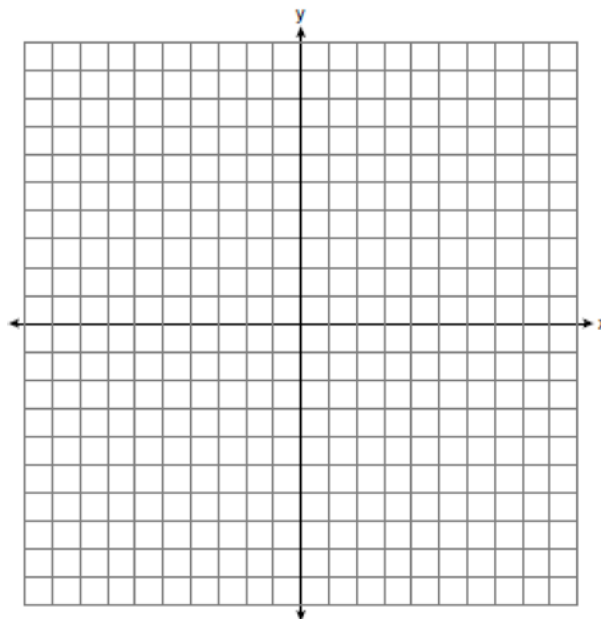
294 Describe the transformation applied to the graph of $p(x) = 2^x$ that forms the new function $q(x) = 2^{x-3} + 4$.

295 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.

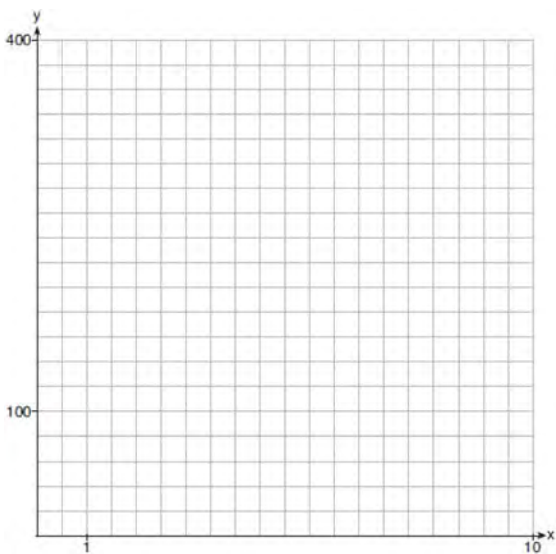


Describe the end behavior of $c(x)$ as x approaches positive infinity. Describe the end behavior of $c(x)$ as x approaches negative infinity.

296 On the axes below, graph $y = 3.2(1.8)^x$.



297 Graph $y = 400(.85)^{2x} - 6$ on the set of axes below.



F.IF.C.8: GRAPHING EXPONENTIAL EQUATIONS

298 Which function represents exponential decay?

- 1 $y = 2^{0.3t}$
- 2 $y = 1.2^{3t}$
- 3 $y = \left(\frac{1}{2}\right)^{-t}$
- 4 $y = 5^{-t}$

299 Which function represents exponential decay?

- 1 $p(x) = \left(\frac{1}{4}\right)^{-x}$
- 2 $q(x) = 1.8^{-x}$
- 3 $r(x) = 2.3^{2x}$
- 4 $s(x) = 4^{\frac{x}{2}}$

300 Which statement is true about the graph of

$$f(x) = \left(\frac{1}{8}\right)^x ?$$

- 1 The graph is always increasing.
- 2 The graph is always decreasing.
- 3 The graph passes through (1,0).
- 4 The graph has an asymptote, $x = 0$.

301 The population of bacteria, $P(t)$, in hundreds, after t hours can be modeled by the function $P(t) = 37e^{0.0532t}$. Determine whether the population is increasing or decreasing over time. Explain your reasoning.

302 The function $M(t)$ represents the mass of radium over time, t , in years.

$$M(t) = 100e^{\frac{\left(\ln \frac{1}{2}\right)t}{1590}}$$

Determine if the function $M(t)$ represents growth or decay. Explain your reasoning.

F.BF.B.5: INVERSE OF FUNCTIONS

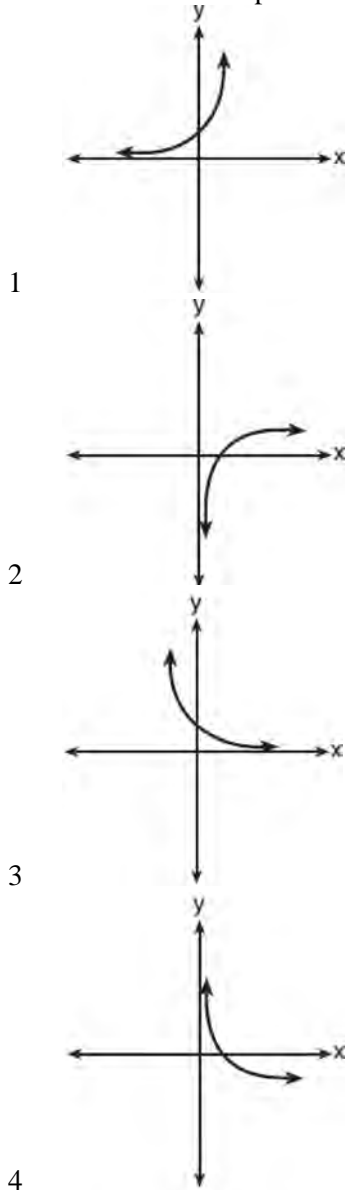
303 If $f(x) = a^x$ where $a > 1$, then the inverse of the function is

- 1 $f^{-1}(x) = \log_x a$
- 2 $f^{-1}(x) = a \log x$
- 3 $f^{-1}(x) = \log_a x$
- 4 $f^{-1}(x) = x \log a$

304 What is the inverse of the function $y = \log_3 x$?

- 1 $y = x^3$
- 2 $y = \log_x 3$
- 3 $y = 3^x$
- 4 $x = 3^y$

305 Which sketch best represents the graph of $x = 3^y$?



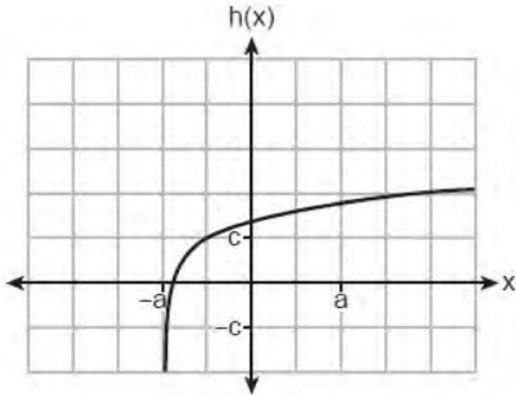
306 Consider the function $f(x) = 2^x$. Is $f(x)$ an even function? Justify your answer. Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units. Write an equation for $h(x)$, the inverse of $g(x)$.

F.IF.C.7: GRAPHING LOGARITHMIC FUNCTIONS

- 307 Given $f(x) = \ln(x + 5)$, what is the *smallest* integer value of x for which $f(x)$ is defined?
- 1 -5
 - 2 -4
 - 3 -1
 - 4 0
- 308 The asymptote of the graph of $f(x) = 5 \log(x + 4)$ is
- 1 $y = 6$
 - 2 $x = -4$
 - 3 $x = 4$
 - 4 $y = 5$
- 309 Which statement about the graph of $c(x) = \log_6 x$ is *false*?
- 1 The asymptote has equation $y = 0$.
 - 2 The graph has no y -intercept.
 - 3 The domain is the set of positive reals.
 - 4 The range is the set of all real numbers.
- 310 Which statement below about the graph of $f(x) = -\log(x + 4) + 2$ is true?
- 1 $f(x)$ has a y -intercept at $(0, 2)$.
 - 2 $-f(x)$ has a y -intercept at $(0, 2)$.
 - 3 As $x \rightarrow \infty, f(x) \rightarrow \infty$.
 - 4 $x \rightarrow -4, f(x) \rightarrow \infty$.
- 311 Which statement best describes the end behavior of the function $y = \log(x - 3)$?
- 1 As $x \rightarrow -\infty, y \rightarrow -\infty$, and as $x \rightarrow \infty, y \rightarrow \infty$.
 - 2 As $x \rightarrow 3, y \rightarrow -\infty$, and as $x \rightarrow \infty, y \rightarrow \infty$.
 - 3 As $x \rightarrow -\infty, y \rightarrow 0$, and as $x \rightarrow \infty, y \rightarrow \infty$.
 - 4 As $x \rightarrow 3, y \rightarrow 0$, and as $x \rightarrow \infty, y \rightarrow \infty$.
- 312 If $f(x) = \log_3 x$ and $g(x)$ is the image of $f(x)$ after a translation five units to the left, which equation represents $g(x)$?
- 1 $g(x) = \log_3(x + 5)$
 - 2 $g(x) = \log_3 x + 5$
 - 3 $g(x) = \log_3(x - 5)$
 - 4 $g(x) = \log_3 x - 5$

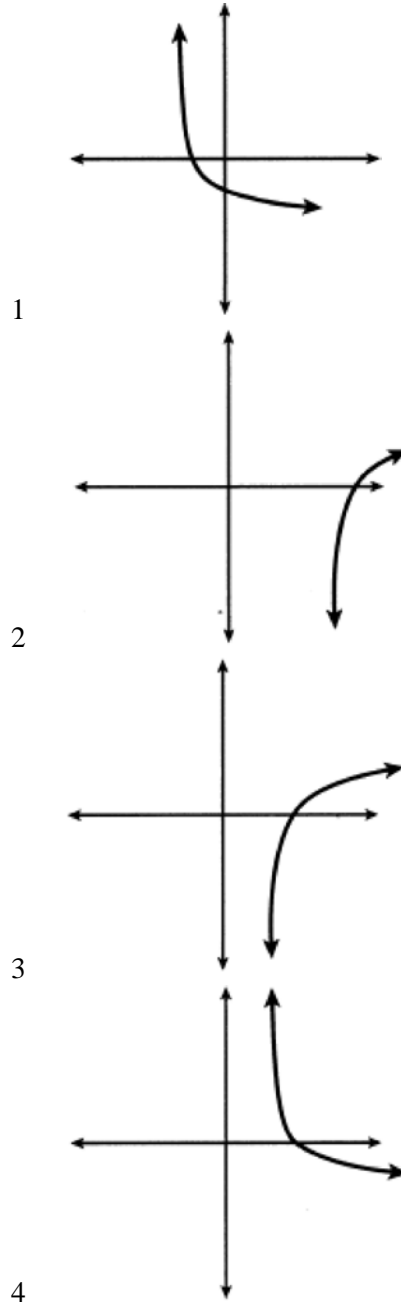
- 313 The graph of $y = \log_2 x$ is translated to the right 1 unit and down 1 unit. The coordinates of the x -intercept of the translated graph are
- 1 (0,0)
 - 2 (1,0)
 - 3 (2,0)
 - 4 (3,0)

- 314 Which equation best represents the graph below?



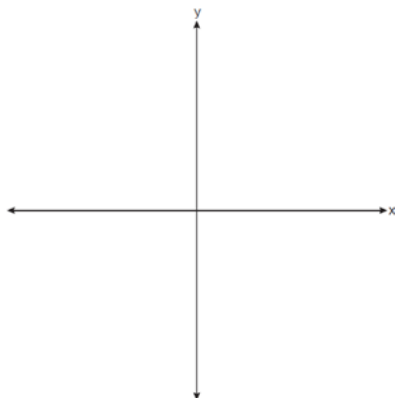
- 1 $h(x) = \log(x + a) + c$
- 2 $h(x) = \log(x - a) + c$
- 3 $h(x) = \log(x + a) - c$
- 4 $h(x) = \log(x - a) - c$

- 315 Which sketch could represent the function $m(x) = -\log_{100}(x - 2)$?



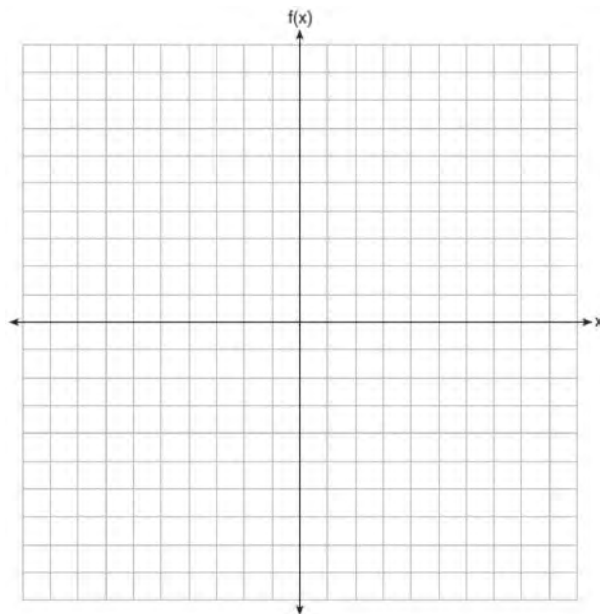
- 316 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

317 Sketch $p(x) = -\log_2(x + 3) + 2$ on the axes below.

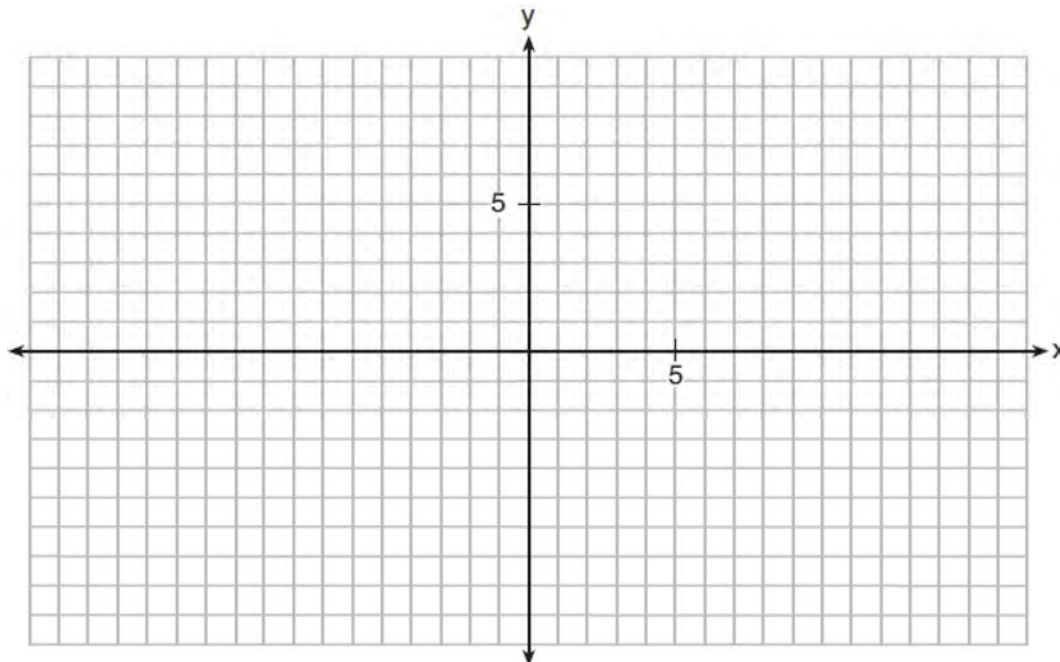


Describe the end behavior of $p(x)$ as $x \rightarrow -3$.
Describe the end behavior of $p(x)$ as $x \rightarrow \infty$

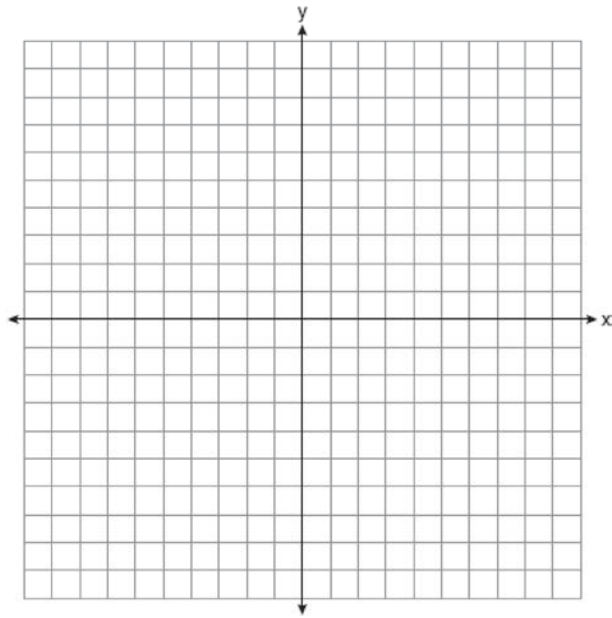
318 Graph $f(x) = \log_2(x + 6)$ on the set of axes below.



319 On the grid below, graph the function $y = \log_2(x - 3) + 1$

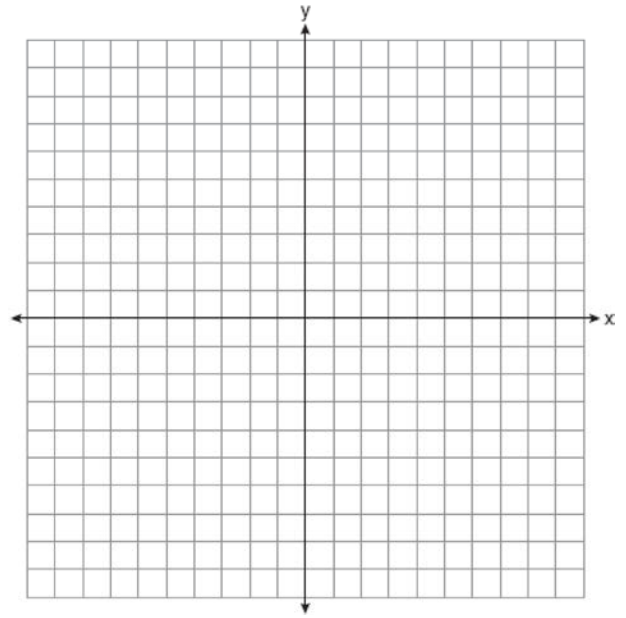


- 320 Graph $y = \log_2(x + 3) - 5$ on the set of axes below.
Use an appropriate scale to include *both* intercepts.



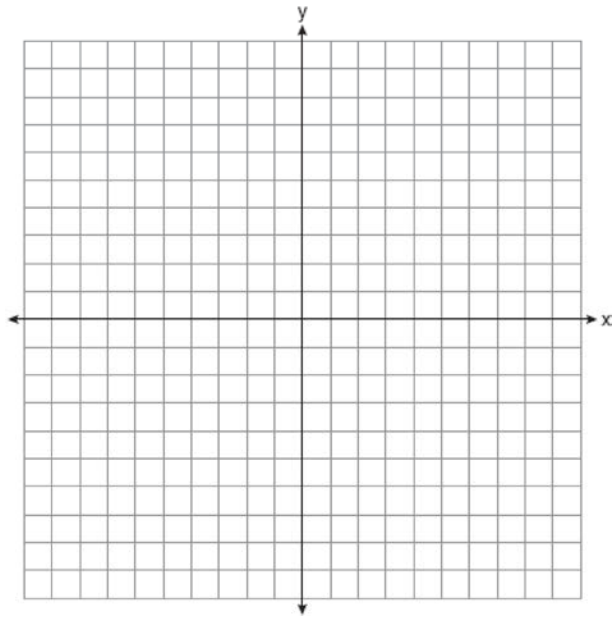
Describe the behavior of the given function as x approaches -3 and as x approaches positive infinity.

- 321 Graph the following function on the axes below.
 $f(x) = \log_3(2 - x)$



State the domain of f . State the equation of the asymptote.

- 322 Graph $y = f(x)$, where $f(x) = \log_2(x - 1) + 3$ on the set of axes below.



State the equation of the asymptote of $f(x)$. When $f(x)$ is reflected over the line $y = x$, a new function is formed: $g(x) = 2^{x-3} + 1$. State the equation of the asymptote of $g(x)$.

F.LE.A.4: EXPRESS EXPONENTIALS AS LOGARITHMS

- 323 Given $p \neq q$, $p = \left(\frac{1}{2}\right)^q$, expressed in logarithmic form, is equivalent to

- 1 $\log_p\left(\frac{1}{2}\right) = q$
- 2 $\log_q(p) = \frac{1}{2}$
- 3 $\log_{\frac{1}{2}}(p) = q$
- 4 $\log_{\frac{1}{2}}(q) = p$

F.LE.A.4: EXPONENTIAL EQUATIONS

- 324 Given $m \neq 0$ and $\left(17^{\frac{1}{m}}\right)^n = 17^2$, what is n in terms

of m ?

- 1 $2m$
 - 2 $\frac{2}{m}$
 - 3 $\frac{m}{2}$
 - 4 2^m
- 325 What is the solution of $2(3^{x+4}) = 56$?
- 1 $x = \log_3(28) - 4$
 - 2 $x = -1$
 - 3 $x = \log(25) - 4$
 - 4 $x = \frac{\log(56)}{\log(6)} - 4$

- 326 If $4(10^{5x-2}) = 12$ then x equals

- 1 $\frac{2.3}{5}$
- 2 $\frac{1}{3} \left(\frac{\log 12}{\log 40} + 5 \right)$
- 3 $\frac{\log(3) + 2}{5}$
- 4 $\frac{1}{5} \left(\frac{\log 12}{\log 4} + 2 \right)$

- 327 What is the solution to $5(2)^{19x} = 50$?

- 1 $x = \frac{\log(50)}{19}$
- 2 $x = \frac{\log_2(10)}{19}$
- 3 $x = \frac{\log_2(45)}{19}$
- 4 $x = \frac{5}{19}$

- 328 If $ae^{bt} = c$, where a , b , and c are positive, then t equals
- $\ln\left(\frac{c}{ab}\right)$
 - $\ln\left(\frac{cb}{a}\right)$
 - $\frac{\ln\left(\frac{c}{a}\right)}{b}$
 - $\frac{\ln\left(\frac{c}{a}\right)}{\ln b}$
- 329 The solution to the equation $6(2^{x+4}) = 36$ is
- -1
 - $\frac{\ln 36}{\ln 12} - 4$
 - $\ln(3) - 4$
 - $\frac{\ln 6}{\ln 2} - 4$
- 330 What is the solution to $8(2^{x+3}) = 48$?
- $x = \frac{\ln 6}{\ln 2} - 3$
 - $x = 0$
 - $x = \frac{\ln 48}{\ln 16} - 3$
 - $x = \ln 4 - 3$
- 331 What is the solution to $9(e^{x-2}) = 36$?
- $x = \frac{\ln(36)}{\ln(9e)} + 2$
 - $x = \ln(4) - 2$
 - $x = \ln(4) + 2$
 - $x = \ln\left(\frac{4}{e}\right) + 2$
- 332 The solution to the equation $5e^{x+2} = 7$ is
- $-2 + \ln\left(\frac{7}{5}\right)$
 - $\left(\frac{\ln 7}{\ln 5}\right) - 2$
 - $\frac{-3}{5}$
 - $-2 + \ln(2)$
- 333 The solution of $87e^{0.3x} = 5918$, to the *nearest thousandth*, is
- 0.583
 - 1.945
 - 4.220
 - 14.066
- 334 To the *nearest tenth*, the solution to the equation $4300e^{0.07x} - 123 = 5000$ is
- 1.1
 - 2.5
 - 6.3
 - 68.5
- 335 Which expression is *not* a solution to the equation $2^t = \sqrt{10}$?
- $\frac{1}{2} \log_2 10$
 - $\log_2 \sqrt{10}$
 - $\log_4 10$
 - $\log_{10} 4$
- 336 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.
- 337 Solve algebraically for x to the *nearest thousandth*: $2e^{0.49x} = 15$
- 338 Solve $3.8e^{1.5t} = 16$ algebraically for t to the *nearest hundredth*.

F.LE.A.4: EXPONENTIAL GROWTH

- 339 A local university has a current enrollment of 12,000 students. The enrollment is increasing continuously at a rate of 2.5% each year. Which logarithm is equal to the number of years it will take for the population to increase to 15,000 students?
- 1 $\frac{\ln 1.25}{0.25}$
 - 2 $\frac{\ln 3000}{0.025}$
 - 3 $\frac{\ln 1.25}{2.5}$
 - 4 $\frac{\ln 1.25}{0.025}$
- 340 Judith puts \$5000 into an investment account with interest compounded continuously. Which approximate annual rate is needed for the account to grow to \$9110 after 30 years?
- 1 2%
 - 2 2.2%
 - 3 0.02%
 - 4 0.022%
- 341 In New York State, the minimum wage has grown exponentially. In 1966, the minimum wage was \$1.25 an hour and in 2015, it was \$8.75. Algebraically determine the rate of growth to the nearest percent.
- 342 A house purchased 5 years ago for \$100,000 was just sold for \$135,000. Assuming exponential growth, approximate the annual growth rate, to the nearest percent.
- 343 Determine, to the nearest tenth of a year, how long it would take an investment to double at a $3\frac{3}{4}\%$ interest rate, compounded continuously.
- 344 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.
- a) Assuming an initial value of 11,000 bacteria, write a function, $p(t)$, that can be used to model the population of bacteria, p , on a smartphone screen, where t represents the time in minutes after it is first observed under a microscope.
 - b) Using $p(t)$ from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.
- 345 Carla wants to start a college fund for her daughter Lila. She puts \$63,000 into an account that grows at a rate of 2.55% per year, compounded monthly. Write a function, $C(t)$, that represents the amount of money in the account t years after the account is opened, given that no more money is deposited into or withdrawn from the account. Calculate algebraically the number of years it will take for the account to reach \$100,000, to the nearest hundredth of a year.
- 346 Seth's parents gave him \$5000 to invest for his 16th birthday. He is considering two investment options. Option A will pay him 4.5% interest compounded annually. Option B will pay him 4.6% compounded quarterly. Write a function of option A and option B that calculates the value of each account after n years. Seth plans to use the money after he graduates from college in 6 years. Determine how much more money option B will earn than option A to the nearest cent. Algebraically determine, to the nearest tenth of a year, how long it would take for option B to double Seth's initial investment.

347 The Manford family started savings accounts for their twins, Abby and Brett, on the day they were born. They invested \$8000 in an account for each child. Abby's account pays 4.2% annual interest compounded quarterly. Brett's account pays 3.9% annual interest compounded continuously. Write a function, $A(t)$, for Abby's account and a function, $B(t)$, for Brett's account that calculates the value of each account after t years. Determine who will have more money in their account when the twins turn 18 years old, and find the difference in the amounts in the accounts to the *nearest cent*. Algebraically determine, to the *nearest tenth of a year*, how long it takes for Brett's account to triple in value.

348 Taylor wants to open an investment account with the \$1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously. Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t , in years. Taylor would like to invest the \$1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer. Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

349 Monthly mortgage payments can be found using the formula below:

$$M = \frac{P \left(\frac{r}{12} \right) \left(1 + \frac{r}{12} \right)^n}{\left(1 + \frac{r}{12} \right)^n - 1}$$

M = monthly payment

P = amount borrowed

r = annual interest rate

n = number of monthly payments

The Banks family would like to borrow \$120,000 to purchase a home. They qualified for an annual interest rate of 4.8%. Algebraically determine the *fewest* number of whole years the Banks family would need to include in the mortgage agreement in order to have a monthly payment of no more than \$720.

- 350 After sitting out of the refrigerator for a while, a turkey at room temperature (68°F) is placed into an oven at 8 a.m., when the oven temperature is 325°F . Newton's Law of Heating explains that the temperature of the turkey will increase proportionally to the difference between the temperature of the turkey and the temperature of the oven, as given by the formula below:

$$T = T_a + (T_0 - T_a)e^{-kt}$$

T_a = the temperature surrounding the object

T_0 = the initial temperature of the object

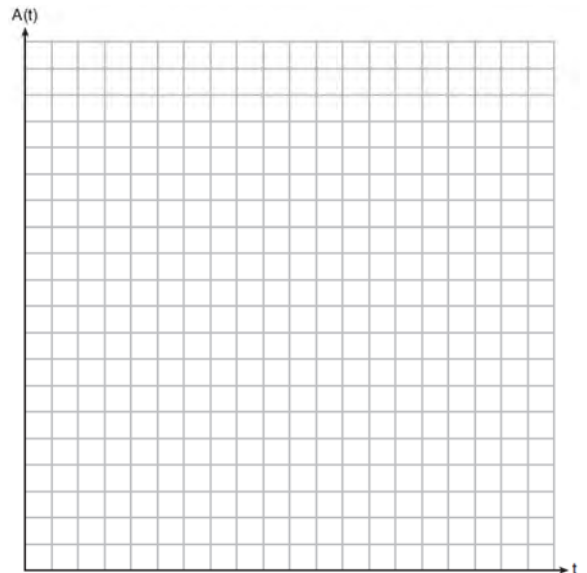
t = the time in hours

T = the temperature of the object after t hours

k = decay constant

The turkey reaches the temperature of approximately 100°F after 2 hours. Find the value of k , to the *nearest thousandth*, and write an equation to determine the temperature of the turkey after t hours. Determine the Fahrenheit temperature of the turkey, to the *nearest degree*, at 3 p.m.

- 351 Tony is evaluating his retirement savings. He currently has $\$318,000$ in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account. Write a function, $A(t)$, to represent the amount of money that will be in his account in t years. Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.



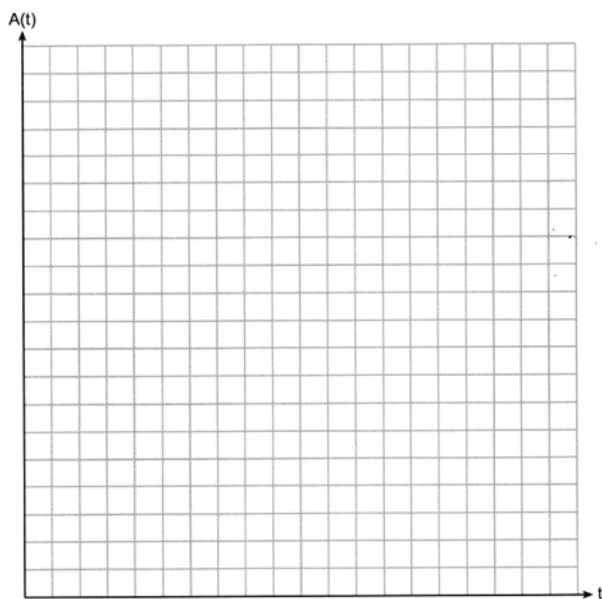
Tony's goal is to save $\$1,000,000$. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal. Explain how your graph of $A(t)$ confirms your answer.

F.LE.A.4: EXPONENTIAL DECAY

- 352 A retailer advertises that items will be discounted by 10% every Monday until they are sold. In how many weeks will an item costing $\$50$ first be sold for under half price?
- 1 7
 - 2 6
 - 3 5
 - 4 4

- 353 The half-life of iodine-131 is 8 days. The percent of the isotope left in the body d days after being introduced is $I = 100\left(\frac{1}{2}\right)^{\frac{d}{8}}$. When this equation is written in terms of the number e , the base of the natural logarithm, it is equivalent to $I = 100e^{kd}$. What is the approximate value of the constant, k ?
- 1 -0.087
 - 2 0.087
 - 3 -11.542
 - 4 11.542
- 354 The Fahrenheit temperature, $F(t)$, of a heated object at time t , in minutes, can be modeled by the function below. F_s is the surrounding temperature, F_0 is the initial temperature of the object, and k is a constant.
- $$F(t) = F_s + (F_0 - F_s)e^{-kt}$$
- Coffee at a temperature of 195°F is poured into a container. The room temperature is kept at a constant 68°F and $k = 0.05$. Coffee is safe to drink when its temperature is, at most, 120°F . To the *nearest minute*, how long will it take until the coffee is safe to drink?
- 1 7
 - 2 10
 - 3 11
 - 4 18
- 355 One of the medical uses of Iodine-131 (I-131), a radioactive isotope of iodine, is to enhance x-ray images. The half-life of I-131 is approximately 8.02 days. A patient is injected with 20 milligrams of I-131. Determine, to the *nearest day*, the amount of time needed before the amount of I-131 in the patient's body is approximately 7 milligrams.
- 356 The half-life of a radioactive substance is 15 years. Write an equation that can be used to determine the amount, $s(t)$, of 200 grams of this substance that remains after t years. Determine algebraically, to the *nearest year*, how long it will take for $\frac{1}{10}$ of this substance to remain.
- 357 A radioactive substance has a mass of 140 g at 3 p.m. and 100 g at 8 p.m. Write an equation in the form $A = A_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$ that models this situation, where h is the constant representing the number of hours in the half-life, A_0 is the initial mass, and A is the mass t hours after 3 p.m. Using this equation, solve for h , to the *nearest ten thousandth*. Determine when the mass of the radioactive substance will be 40 g. Round your answer to the *nearest tenth of an hour*.
- 358 Megan is performing an experiment in a lab where the air temperature is a constant 73°F and the liquid is 237°F . One and a half hours later, the temperature of the liquid is 112°F . Newton's law of cooling states $T(t) = T_a + (T_0 - T_a)e^{-kt}$ where:
- $T(t)$: temperature, $^\circ\text{F}$, of the liquid at t hours
 - T_a : air temperature
 - T_0 : initial temperature of the liquid
 - k : constant
- Determine the value of k , to the *nearest thousandth*, for this liquid. Determine the temperature of the liquid using your value for k , to the *nearest degree*, after two and a half hours. Megan needs the temperature of the liquid to be 80°F to perform the next step in her experiment. Use your value for k to determine, to the *nearest tenth of an hour*, how much time she must wait since she first began the experiment.

- 359 Cesium-137 decay can be modeled with the formula $A(t) = A_0 e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k , to the nearest thousandth. Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t , in years. Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the nearest tenth. Explain what this value means in the given context.

RATIONALS

A.APR.D.6: UNDEFINED RATIONALS

- 360 The function $f(x) = \frac{x-3}{x^2+2x-8}$ is undefined when x equals
- 1 2 or -4
 - 2 4 or -2
 - 3 3, only
 - 4 2, only

A.APR.D.6: RATIONAL EXPRESSIONS

- 361 Which expression(s) are equivalent to $\frac{x^2 - 4x}{2x}$, where $x \neq 0$?

I. $\frac{x}{2} - 2$ II. $\frac{x-4}{2}$ III. $\frac{x-1}{2} - \frac{3}{2}$

- 1 II, only
- 2 I and II
- 3 II and III
- 4 I, II, and III

- 362 Written in simplest form, the fraction $\frac{x^3 - 9x}{9 - x^2}$,

where $x \neq \pm 3$, is equivalent to

- 1 $-x$
- 2 x
- 3 $\frac{-x(x+3)}{(3+x)}$
- 4 $\frac{x(x-3)}{(3-x)}$

- 363 For all values of x for which the expression is defined, $\frac{x^2 + 3x}{x^2 + 5x + 6}$ is equivalent to

- 1 $1 - \frac{x}{x+2}$
- 2 $\frac{x}{x+2}$
- 3 $\frac{3x}{5x+6}$
- 4 $1 + \frac{1}{2x+6}$

- 364 The expression $\frac{-3x^2 - 5x + 2}{x^3 + 2x^2}$ can be rewritten as

- 1 $\frac{-3x-3}{x^2+2x}$
- 2 $\frac{-3x-1}{x^2}$
- 3 $-3x^{-1} + 1$
- 4 $-3x^{-1} + x^{-2}$

365 For all values of x for which the expression is defined, $\frac{x^3 + 2x^2 - 9x - 18}{x^3 - x^2 - 6x}$, in simplest form, is

equivalent to

1 3

2 $-\frac{17}{2}$

3 $\frac{x+3}{x}$

4 $\frac{x^2 - 9}{x(x-3)}$

366 Which expression can be rewritten as $(x+7)(x-1)$?

1 $(x+3)^2 - 16$

2 $(x+3)^2 - 10(x+3) - 2(x+3) + 20$

3 $\frac{(x-1)(x^2 - 6x - 7)}{(x+1)}$

4 $\frac{(x+7)(x^2 + 4x + 3)}{(x+3)}$

367 For all values for which the expressions are defined, which expression can *not* be rewritten as $(x-6)(x+2)$?

1 $\frac{(x+2)(x^2 - 2x - 24)}{(x+4)}$

2 $x(x+2) - 6(x+2)$

3 $\frac{(x-2)(x^2 - 4x - 12)}{(x-6)}$

4 $(x+4)(x-2) - 2(3x+2)$

368 For all values of x for which the expression is defined, write the expression below in simplest form.

$$\frac{2x^3 + x^2 - 18x - 9}{3x - x^2}$$

369 Written in simplest form, $\frac{c^2 - d^2}{d^2 + cd - 2c^2}$ where $c \neq d$, is equivalent to

1 $\frac{c+d}{d+2c}$

2 $\frac{c-d}{d+2c}$

3 $\frac{-c-d}{d+2c}$

4 $\frac{-c+d}{d+2c}$

370 For $x \neq \pm 4y$, the expression $\frac{x^2 + 3xy - 28y^2}{16y^2 - x^2}$ is

equivalent to

1 $-1 - \frac{7}{4}y$

2 $\frac{x-7y}{4y-x}$

3 $\frac{x+7y}{x+4y}$

4 $\frac{-x-7y}{x+4y}$

371 Given $x \neq -2$, the expression $\frac{2x^2 + 5x + 8}{x+2}$ is

equivalent to

1 $2x^2 + \frac{9}{x+2}$

2 $2x + \frac{7}{x+2}$

3 $2x + 1 + \frac{6}{x+2}$

4 $2x + 9 - \frac{10}{x+2}$

372 Given $f(x) = 2x^3 - 3x^2 - 5x - 12$ and $g(x) = x - 3$, the quotient of $\frac{f(x)}{g(x)}$ is

1 $2x^2 + 3x + 4$

2 $2x^3 + 3x^2 + 4x$

3 $2x^2 - 9x + 22 - \frac{78}{x-3}$

4 $2x^3 - 9x^2 + 22x - 78$

373 The expression $\frac{x^3 + 2x^2 + x + 6}{x + 2}$ is equivalent to

- 1 $x^2 + 3$
- 2 $x^2 + 1 + \frac{4}{x + 2}$
- 3 $2x^2 + x + 6$
- 4 $2x^2 + 1 + \frac{4}{x + 2}$

374 The result of dividing $2x^3 + 6x^2 + 7x + 2$ by $x + 1$ is

- 1 $2x^2 + 4x + 3 - \frac{1}{x + 1}$
- 2 $2x^2 + 4x + 3 + \frac{5}{x + 1}$
- 3 $2x^2 + 8x - 15 + \frac{17}{x + 1}$
- 4 $2x^2 + 8x + 15 - \frac{13}{x + 1}$

375 Given $x \neq -3$, which expression is equivalent to

- $\frac{2x^3 + 3x^2 - 4x + 5}{x + 3}$?
- 1 $2x^3 + 9x^2 + 23x + 74$
 - 2 $2x^2 - 3x + 5 - \frac{10}{x + 3}$
 - 3 $2x^3 - 3x^2 + 5x - 10$
 - 4 $2x^2 + 9x + 23 + \frac{74}{x + 3}$

376 Given $x \neq -3$, the expression $\frac{2x^3 + 7x^2 - 3x - 25}{x + 3}$ is equivalent to

- 1 $2x^2 + x - 6 - \frac{7}{x + 3}$
- 2 $2x^2 + 13x - 36 + \frac{83}{x + 3}$
- 3 $2x^2 + x - 13$
- 4 $x^2 + 4x - 15 + \frac{20}{x + 3}$

377 Which expression is equivalent to $\frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x + 6}$?

- 1 $2x^3 + 4x^2 + x - 12 + \frac{86}{x + 6}$
- 2 $2x^3 - 4x^2 - x + 14$
- 3 $2x^3 - 4x^2 - x + \frac{14}{x + 6}$
- 4 $2x^3 - 4x^2 - x$

378 Which expression is equivalent to $\frac{x^3 - 2}{x - 2}$?

- 1 x^2
- 2 $x^2 + 2x + 4 + \frac{6}{x - 2}$
- 3 $x^2 - 2$
- 4 $x^2 - 2x + 4 - \frac{10}{x - 2}$

379 The expression $\frac{x^4 - 5x^2 + 4x + 14}{x + 2}$ is equivalent to

- 1 $x^3 - 2x^2 - x + 6 + \frac{2}{x + 2}$
- 2 $x^3 - 5x + 4 - \frac{14}{x + 2}$
- 3 $x^3 + 2x^2 - x + 2 + \frac{18}{x + 2}$
- 4 $x^3 + 2x^2 - 9x + 22 - \frac{30}{x + 2}$

380 The rational expression $\frac{2x^4 - 5x^2 + 3x - 2}{x - 3}$ is equivalent to

- 1 $2x^3 - 5x - 12 - \frac{38}{x - 3}$
- 2 $2x^3 + 6x^2 + 13x + 42 + \frac{124}{x - 3}$
- 3 $2x^3 - 5x + 18 - \frac{56}{x - 3}$
- 4 $2x^3 - 6x^2 + 13x - 36 + \frac{106}{x - 3}$

381 Which expression is equivalent to

$$\frac{6x^4 + 4x^3 + x + 200}{x + 2}?$$

- 1 $6x^2 - 8x + 17 + \frac{166}{x + 2}$
- 2 $6x^2 + 16x + 33 + \frac{266}{x + 2}$
- 3 $6x^3 + 16x^2 + 32x + 65 + \frac{330}{x + 2}$
- 4 $6x^3 - 8x^2 + 16x - 31 + \frac{262}{x + 2}$

382 What is the quotient when $10x^3 - 3x^2 - 7x + 3$ is divided by $2x - 1$?

- 1 $5x^2 + x + 3$
- 2 $5x^2 - x + 3$
- 3 $5x^2 - x - 3$
- 4 $5x^2 + x - 3$

383 Which expression is equivalent to

$$\frac{6x^3 + 7x^2 - 9x - 1}{2x - 1} \text{ when } x \neq \frac{1}{2}?$$

- 1 $3x^2 - 2x - 4$
- 2 $3x^2 + 5x - 7 - \frac{8}{2x - 1}$
- 3 $3x^2 + 2x + 5 - \frac{6}{2x - 1}$
- 4 $3x^2 + 5x - 2 - \frac{3}{2x - 1}$

384 The expression $\frac{6x^3 + 17x^2 + 10x + 2}{2x + 3}$ equals

- 1 $3x^2 + 4x - 1 + \frac{5}{2x + 3}$
- 2 $6x^2 + 8x - 2 + \frac{5}{2x + 3}$
- 3 $6x^2 - x + 13 - \frac{37}{2x + 3}$
- 4 $3x^2 + 13x + \frac{49}{2} + \frac{151}{2x + 3}$

385 The expression $\frac{9x^2 - 2}{3x + 1}$ is equivalent to

- 1 $3x - 1 - \frac{1}{3x + 1}$
- 2 $3x - 1 + \frac{1}{3x + 1}$
- 3 $3x + 1 - \frac{1}{3x + 1}$
- 4 $3x + 1 + \frac{1}{3x + 1}$

386 Which expression is equivalent to $\frac{2x^3 + 2x - 7}{2x + 4}$?

- 1 $x^2 - 2x + 5 - \frac{27}{2x + 4}$
- 2 $x^2 - 1 - \frac{3}{2x + 4}$
- 3 $x^2 + 2x + 5 + \frac{13}{2x + 4}$
- 4 $x^2 + 2x - 3 + \frac{5}{2x + 4}$

387 Which expression is equivalent to $\frac{4x^3 + 9x - 5}{2x - 1}$,where $x \neq \frac{1}{2}$?

- 1 $2x^2 + x + 5$
- 2 $2x^2 + \frac{11}{2} + \frac{1}{2(2x - 1)}$
- 3 $2x^2 - x + 5$
- 4 $2x^2 - x + 4 + \frac{1}{2x - 1}$

388 The expression $\frac{4x^3 + 5x + 10}{2x + 3}$ is equivalent to

- 1 $2x^2 + 3x - 7 + \frac{31}{2x + 3}$
- 2 $2x^2 - 3x + 7 - \frac{11}{2x + 3}$
- 3 $2x^2 + 2.5x + 5 + \frac{15}{2x + 3}$
- 4 $2x^2 - 2.5x - 5 - \frac{20}{2x + 3}$

389 Given $f(x) = 3x^2 + 7x - 20$ and $g(x) = x - 2$, state the quotient and remainder of $\frac{f(x)}{g(x)}$, in the form

$$q(x) + \frac{r(x)}{g(x)}.$$

390 Determine the quotient and remainder when $(6a^3 + 11a^2 - 4a - 9)$ is divided by $(3a - 2)$.

Express your answer in the form $q(a) + \frac{r(a)}{d(a)}$.

391 Given $f(x) = 3x^3 - 4x^2 + 2x - 1$ and $g(x) = x - 4$, state the quotient and remainder of $\frac{f(x)}{g(x)}$, in the

form $q(x) + \frac{r(x)}{g(x)}$. Is $x = 4$ a root of $f(x)$? Explain your answer.

392 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$. Is $b(x)$ a factor of $a(x)$? Explain.

393 When the function $p(x)$ is divided by $x - 1$ the quotient is $x^2 + 7 + \frac{5}{x - 1}$. State $p(x)$ in standard form.

394 The expression $\frac{x^2 + 12}{x^2 + 3}$ can be rewritten as

- 1 $\frac{10}{x^2 + 3}$
- 2 $1 + \frac{9}{x^2 + 3}$
- 3 $x + 9$
- 4 4

395 The expression $\frac{x^2 + 6}{x^2 + 4}$ is equivalent to

- 1 $\frac{6}{4}$
- 2 $1 + \frac{10}{x^2 + 4}$
- 3 $1 - \frac{2}{x^2 + 4}$
- 4 $1 + \frac{2}{x^2 + 4}$

396 The expression $\frac{4x^2 - 5}{x^2 - 1}$ is equivalent to

- 1 $4 - \frac{1}{x^2 - 1}$
- 2 $4 + \frac{1}{x^2 - 1}$
- 3 $4 - \frac{9}{x^2 - 1}$
- 4 $4 - \frac{4}{x^2 - 1}$

397 The expression $2 - \frac{x - 1}{x + 2}$ is equivalent to

- 1 $1 - \frac{3}{x + 2}$
- 2 $1 + \frac{3}{x + 2}$
- 3 $1 - \frac{1}{x + 2}$
- 4 $1 + \frac{1}{x + 2}$

398 Algebraically prove that $\frac{x^3 + 9}{x^3 + 8} = 1 + \frac{1}{x^3 + 8}$, where $x \neq -2$.

A.CED.A.1: MODELING RATIONALS

- 399 Mallory wants to buy a new window air conditioning unit. The cost for the unit is \$329.99. If she plans to run the unit three months out of the year for an annual operating cost of \$108.78, which function models the cost per year over the lifetime of the unit, $C(n)$, in terms of the number of years, n , that she owns the air conditioner.
- 1 $C(n) = 329.99 + 108.78n$
 - 2 $C(n) = 329.99 + 326.34n$
 - 3 $C(n) = \frac{329.99 + 108.78n}{n}$
 - 4 $C(n) = \frac{329.99 + 326.34n}{n}$
- 400 A manufacturing plant produces two different-sized containers of peanuts. One container weighs x ounces and the other weighs y pounds. If a gift set can hold one of each size container, which expression represents the number of gift sets needed to hold 124 ounces?
- 1 $\frac{124}{16x + y}$
 - 2 $\frac{x + 16y}{124}$
 - 3 $\frac{124}{x + 16y}$
 - 4 $\frac{16x + y}{124}$
- 401 Julie averaged 85 on the first three tests of the semester in her mathematics class. If she scores 93 on each of the remaining tests, her average will be 90. Which equation could be used to determine how many tests, T , are left in the semester?
- 1 $\frac{255 + 93T}{3T} = 90$
 - 2 $\frac{255 + 90T}{3T} = 93$
 - 3 $\frac{255 + 93T}{T + 3} = 90$
 - 4 $\frac{255 + 90T}{T + 3} = 93$
- 402 Reynaldo got a score of 40 on his first test. If he gets a score of 100 on every additional test, which equation can be used to determine the number of additional tests, x , he would need to take in order to raise his test average to an 80?
- 1 $\frac{40 + 100x}{x + 1} = 80$
 - 2 $\frac{40 + 100x}{x} = 80$
 - 3 $\frac{40 + 100 + x}{x} = 80$
 - 4 $\frac{40 + 100 + x}{x + 1} = 80$
- 403 A rush-hour commuter train has arrived on time 64 of its first 80 days. As arrivals continue, which equation can be used to find x , the number of consecutive days that the train must arrive on schedule to raise its on-time performance rate to 90%?
- 1 $\frac{64}{80 + x} = \frac{90}{100}$
 - 2 $\frac{64 + x}{80 + x} = \frac{90}{100}$
 - 3 $\frac{64 + x}{80} = \frac{90}{100}$
 - 4 $\frac{x}{80 + x} = \frac{90}{100}$
- 404 In order to qualify for a college tennis scholarship, Joe needs to win 90% of the matches he plays during his senior year of high school. If he has won 8 of the 10 matches that he has played, which equation can be used to determine how many more consecutive matches, x , Joe must win in order for his winning percentage to equal 90%?
- 1 $\frac{8 + x}{x} = 0.90$
 - 2 $\frac{8}{10 + x} = 0.90$
 - 3 $\frac{8}{10} + x = 0.90$
 - 4 $\frac{8 + x}{10 + x} = 0.90$

- 405 A number, minus twenty times its reciprocal, equals eight. The number is

1 10 or -2
 2 10 or 2
 3 -10 or -2
 4 -10 or 2

A.REI.A.2: SOLVING RATIONALS

- 406 The equation $\frac{1}{x} - \frac{1}{5} = \frac{x}{5}$ has

1 rational solutions
 2 irrational solutions
 3 imaginary solutions
 4 no solutions

- 407 The focal length, F , of a camera's lens is related to the distance of the object from the lens, J , and the distance to the image area in the camera, W , by the formula below.

$$\frac{1}{J} + \frac{1}{W} = \frac{1}{F}$$

When this equation is solved for J in terms of F and W , J equals

1 $F - W$
 2 $\frac{FW}{F - W}$
 3 $\frac{FW}{W - F}$
 4 $\frac{1}{F} - \frac{1}{W}$

- 408 What is the solution set of the equation

$$\frac{2}{x} - \frac{3x}{x+3} = \frac{x}{x+3}?$$

1 $\{3\}$
 2 $\left\{\frac{3}{2}\right\}$
 3 $\{-2, 3\}$
 4 $\left\{-1, \frac{3}{2}\right\}$

- 409 What is the solution set of the equation

$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1}?$$

1 $\left\{-\frac{1}{3}, \frac{1}{2}\right\}$

2 $\left\{-\frac{1}{3}\right\}$

3 $\left\{\frac{1}{2}\right\}$

4 $\left\{\frac{1}{3}, -2\right\}$

- 410 What is the solution set of the equation

$$\frac{3x+25}{x+7} - 5 = \frac{3}{x}?$$

1 $\left\{\frac{3}{2}, 7\right\}$

2 $\left\{\frac{7}{2}, -3\right\}$

3 $\left\{-\frac{3}{2}, 7\right\}$

4 $\left\{-\frac{7}{2}, -3\right\}$

- 411 What is the solution set of the equation

$$\frac{x+2}{x} + \frac{x}{3} = \frac{2x^2+6}{3x}?$$

1 $\{-3\}$

2 $\{-3, 0\}$

3 $\{3\}$

4 $\{0, 3\}$

- 412 What is the solution set of the equation

$$\frac{10}{x^2-2x} + \frac{4}{x} = \frac{5}{x-2}?$$

1 $\{0, 2\}$

2 $\{0\}$

3 $\{2\}$

4 $\{ \}$

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- 413 The solution set of $\frac{x+3}{x-5} + \frac{6}{x+2} = \frac{6+10x}{(x-5)(x+2)}$ is
- 1 $\{-6\}$
 - 2 $\{5\}$
 - 3 $\{-6, 5\}$
 - 4 $\{-5, 6\}$
- 414 The solution of $\frac{x}{x+3} + \frac{2}{x-4} = \frac{2x+27}{x^2-x-12}$ is
- 1 -3
 - 2 -7
 - 3 3
 - 4 7
- 415 What is the solution, if any, of the equation $\frac{2}{x+3} - \frac{3}{4-x} = \frac{2x-2}{x^2-x-12}$?
- 1 -1
 - 2 -5
 - 3 all real numbers
 - 4 no real solution
- 416 What is the solution set of the equation $\frac{4}{k^2-8k+12} = \frac{k}{k-2} + \frac{1}{k-6}$?
- 1 $\{-1, 6\}$
 - 2 $\{1, -6\}$
 - 3 $\{-1\}$
 - 4 $\{1\}$
- 417 To solve the equation $\frac{7}{x+7} + \frac{4x}{x-7} = \frac{3x+7}{x-7}$, Joan's first step is to multiply both sides by the least common denominator. Which statement is true?
- 1 -14 is an extraneous solution.
 - 2 7 and -7 are extraneous solutions.
 - 3 7 is an extraneous solution.
 - 4 There are no extraneous solutions.
- 418 To solve $\frac{2x}{x-2} - \frac{11}{x} = \frac{8}{x^2-2x}$, Ren multiplied both sides by the least common denominator. Which statement is true?
- 1 2 is an extraneous solution.
 - 2 $\frac{7}{2}$ is an extraneous solution.
 - 3 0 and 2 are extraneous solutions.
 - 4 This equation does not contain any extraneous solutions.
- 419 The solutions to $x+3 - \frac{4}{x-1} = 5$ are
- 1 $\frac{3}{2} \pm \frac{\sqrt{17}}{2}$
 - 2 $\frac{3}{2} \pm \frac{\sqrt{17}}{2}i$
 - 3 $\frac{3}{2} \pm \frac{\sqrt{33}}{2}$
 - 4 $\frac{3}{2} \pm \frac{\sqrt{33}}{2}i$
- 420 The solution set to the equation $\frac{2}{x^3} + \frac{1}{x} = \frac{6}{x^3}$ is
- 1 $\{-2, 0, 2\}$
 - 2 $\{2\}$
 - 3 $\{-2, 2\}$
 - 4 $\{0, 2\}$
- 421 Solve for x : $\frac{1}{x} - \frac{1}{3} = -\frac{1}{3x}$
- 422 Solve algebraically for x : $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$
- 423 Solve algebraically for n : $\frac{2}{n^2} + \frac{3}{n} = \frac{4}{n^2}$
- 424 Solve for all values of p : $\frac{3p}{p-5} - \frac{2}{p+3} = \frac{p}{p+3}$
- 425 Solve algebraically for all values of x : $\frac{8}{x+5} - \frac{3}{x} = 5$

426 Algebraically solve for x : $\frac{7}{2x} - \frac{2}{x+1} = \frac{1}{4}$

427 Algebraically solve for x : $\frac{-3}{x+3} + \frac{1}{2} = \frac{x}{6} - \frac{1}{2}$

428 Solve for x algebraically:

$$\frac{1}{x-6} + \frac{x}{x-2} = \frac{4}{x^2 - 8x + 12}$$

429 Solve algebraically for x : $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.430 Markus is a long-distance walker. In one race, he walked 55 miles in t hours and in another race walked 65 miles in $t+3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \quad r = \frac{65}{t+3}$$

Markus walked at an equivalent rate, r , for each race. Determine the number of hours that each of the two races took.

431 A formula for work problems involving two people is shown below.

$$\frac{1}{t_1} + \frac{1}{t_2} = \frac{1}{t_b}$$

 t_1 = the time taken by the first person to complete the job t_2 = the time taken by the second person to complete the job t_b = the time it takes for them working together to complete the jobFred and Barney are carpenters who build the same model desk. It takes Fred eight hours to build the desk while it only takes Barney six hours. Write an equation that can be used to find the time it would take both carpenters working together to build a desk. Determine, to the *nearest tenth of an hour*, how long it would take Fred and Barney working together to build a desk.

SYSTEMS

A.REI.C.7: QUADRATIC-LINEAR SYSTEMS

432 How many real solutions exist for the system of equations below?

$$y = \frac{1}{4}x - 8$$

$$y = \frac{1}{2}x^2 + 2x$$

- 1 1
- 2 2
- 3 3
- 4 0

433 Which point is in Quadrant III and is a solution to the system below?

$$y = x^2 - 24$$

$$y = x - 12$$

- 1 (4, -8)
- 2 (-3, -15)
- 3 (-4, -16)
- 4 (-3, -33)

434 The graphs of the equations $y = x^2 + 4x - 1$ and $y + 3 = x$ are drawn on the same set of axes. One solution of this system is

- 1 (-5, -2)
- 2 (-1, -4)
- 3 (1, 4)
- 4 (-2, -1)

435 What is the solution set of the following system of equations?

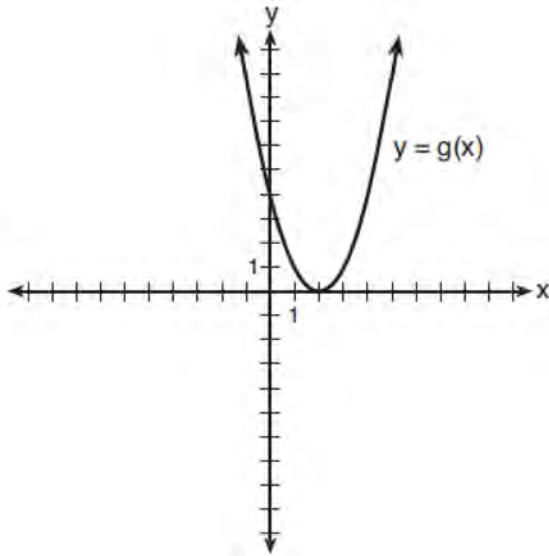
$$y = 3x + 6$$

$$y = (x+4)^2 - 10$$

- 1 $\{(-5, -9)\}$
- 2 $\{(5, 21)\}$
- 3 $\{(0, 6), (-5, -9)\}$
- 4 $\{(0, 6), (5, 21)\}$

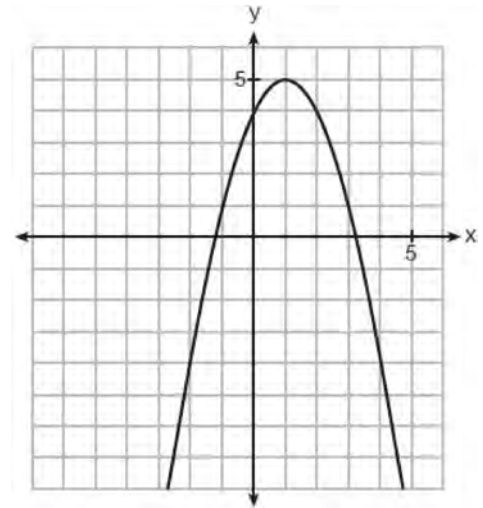
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- 436 What is the solution to the system of equations $y = 3x - 2$ and $y = g(x)$ where $g(x)$ is defined by the function below?



- 1 $\{(0, -2)\}$
- 2 $\{(0, -2), (1, 6)\}$
- 3 $\{(1, 6)\}$
- 4 $\{(1, 1), (6, 16)\}$

- 437 The graph of a quadratic function is shown below.



When the graph of $x + y = 4$ is drawn on the same axes, one solution to this system is

- 1 $(4, 0)$
 - 2 $(1, 5)$
 - 3 $(2, 2)$
 - 4 $(3, 1)$
- 438 Algebraically determine the values of x that satisfy the system of equations below:

$$y = x^2 + 8x - 5$$

$$y = 8x - 4$$

- 439 Algebraically determine the values of x that satisfy the system of equations below.

$$y = -2x + 1$$

$$y = -2x^2 + 3x + 1$$

- 440 Algebraically determine the solution set for the system of equations below.

$$y = 2x^2 - 7x + 4$$

$$y = 11 - 2x$$

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- 441 Consider the system shown below.

$$2x - y = 4$$

$$(x + 3)^2 + y^2 = 8$$

The two solutions of the system can be described as

- 1 both imaginary
- 2 both irrational
- 3 both rational
- 4 one rational and one irrational

- 442 Given $y = -2x$ and $x^2 + y^2 = 5$, the point of intersection in Quadrant II is

- 1 $(1, -2)$
- 2 $(-2, 1)$
- 3 $(-1, 1)$
- 4 $(-1, 2)$

- 443 What are the solution(s) to the system of equations shown below?

$$x^2 + y^2 = 5$$

$$y = 2x$$

- 1 $x = 1$ and $x = -1$
 - 2 $x = 1$
 - 3 $(1, 2)$ and $(-1, -2)$
 - 4 $(1, 2)$, only
- 444 What is one solution to the system of equations shown below?

$$x^2 + y^2 = 20$$

$$y = x - 6$$

- 1 $x = 2$
 - 2 $(4, -2)$
 - 3 $y = -4$
 - 4 $(4, 2)$
- 445 Solve the system of equations algebraically.

$$x^2 + y^2 = 25$$

$$y + 5 = 2x$$

- 446 Solve the following system of equations algebraically. $x^2 + y^2 = 400$

$$y = x - 28$$

- 447 Algebraically solve the system:

$$(x - 2)^2 + (y - 3)^2 = 20$$

$$y = -2x + 7$$

- 448 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$

$$x - y = 6$$

- 449 Solve the system of equations shown below algebraically.

$$(x - 3)^2 + (y + 2)^2 = 16$$

$$2x + 2y = 10$$

- 450 Algebraically solve the following system of equations.

$$(x - 2)^2 + (y - 3)^2 = 16$$

$$x + y - 1 = 0$$

A.REI.D.11: QUADRATIC-LINEAR SYSTEMS

- 451 Sally's high school is planning their spring musical. The revenue, R , generated can be determined by the function $R(t) = -33t^2 + 360t$, where t represents the price of a ticket. The production cost, C , of the musical is represented by the function $C(t) = 700 + 5t$. What is the highest ticket price, to the *nearest dollar*, they can charge in order to *not* lose money on the event?

- 1 $t = 3$
- 2 $t = 5$
- 3 $t = 8$
- 4 $t = 11$

A.REI.D.11: OTHER SYSTEMS

452 Selected values for the functions f and g are shown in the tables below.

x	$f(x)$	x	$g(x)$
-3.12	-4.88	-2.01	-1.01
0	-6	0	0.58
1.23	-4.77	8.52	2.53
8.52	2.53	13.11	3.01
9.01	3.01	16.52	3.29

A solution to the equation $f(x) = g(x)$ is

- | | | | |
|---|------|---|------|
| 1 | 0 | 3 | 3.01 |
| 2 | 2.53 | 4 | 8.52 |

453 Which value, to the *nearest tenth*, is *not* a solution of $p(x) = q(x)$ if $p(x) = x^3 + 3x^2 - 3x - 1$ and $q(x) = 3x + 8$?

- 1 -3.9
- 2 -1.1
- 3 2.1
- 4 4.7

454 If $f(x) = 3|x| - 1$ and $g(x) = 0.03x^3 - x + 1$, an approximate solution for the equation $f(x) = g(x)$ is

- 1 1.96
- 2 11.29
- 3 (-0.99, 1.96)
- 4 (11.29, 32.87)

455 If $f(x) = (x^2 + 3x + 2)(x^2 - 4x + 3)$ and $g(x) = x^2 - 9$, then how many real solutions are there to the equation $f(x) = g(x)$?

- 1 1
- 2 2
- 3 6
- 4 4

456 Given: $h(x) = \frac{2}{9}x^3 + \frac{8}{9}x^2 - \frac{16}{13}x + 2$

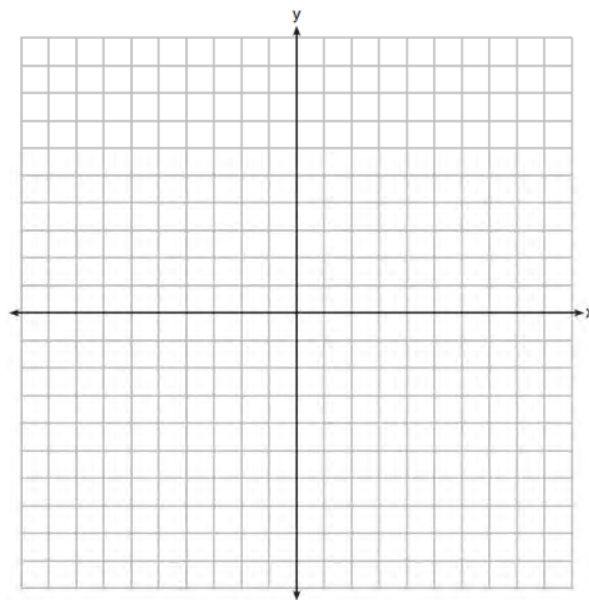
$$k(x) = -|0.7x| + 5$$

State the solutions to the equation $h(x) = k(x)$, rounded to the *nearest hundredth*.

457 On the set of axes below, graph $y = f(x)$ and $y = g(x)$ for the given functions.

$$f(x) = x^3 - 3x^2$$

$$g(x) = 2x - 5$$



State the number of solutions to the equation $f(x) = g(x)$.

- 458 To the *nearest tenth*, the value of x that satisfies $2^x = -2x + 11$ is
- 1 2.5
 - 2 2.6
 - 3 5.8
 - 4 5.9

- 459 The equations $y = 3t + 6$ and $y = (1.82)^t$ approximately model the growth of two separate populations where $t > 0$. What is the best approximation of the time, t , at which the populations are the same?
- 1 -1.9
 - 2 0.3
 - 3 5.1
 - 4 21.3

- 461 The populations of two small towns at the beginning of 2018 and their annual population growth rate are shown in the table below.

Town	Population	Annual Population Growth Rate
Jonesville	1240	6% increase
Williamstown	890	11% increase

Assuming the trend continues, approximately how many years after the beginning of 2018 will it take for the populations to be equal?

- | | |
|---|---|
| <ol style="list-style-type: none"> 1 7 2 20 | <ol style="list-style-type: none"> 3 68 4 125 |
|---|---|
- 462 During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank *A* at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank *B* at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after t years if no other deposits or withdrawals are made, where Adam's account value is represented by $A(t)$, and Betty's by $B(t)$. Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.
- 463 Researchers in a local area found that the population of rabbits with an initial population of 20 grew continuously at the rate of 5% per month. The fox population had an initial value of 30 and grew continuously at the rate of 3% per month. Find, to the *nearest tenth of a month*, how long it takes for these populations to be equal.

464 On a certain tropical island, there are currently 500 palm trees and 200 flamingos. Suppose the palm tree population is decreasing at an annual rate of 3% per year and the flamingo population is growing at a continuous rate of 2% per year. Write two functions, $P(x)$ and $F(x)$, that represent the number of palm trees and flamingos on this island, respectively, x years from now. State the solution to the equation $P(x) = F(x)$, rounded to the *nearest year*. Interpret the meaning of this value within the given context.

465 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0 : initial temperature

T_R : room temperature

r : rate of cooling of the object

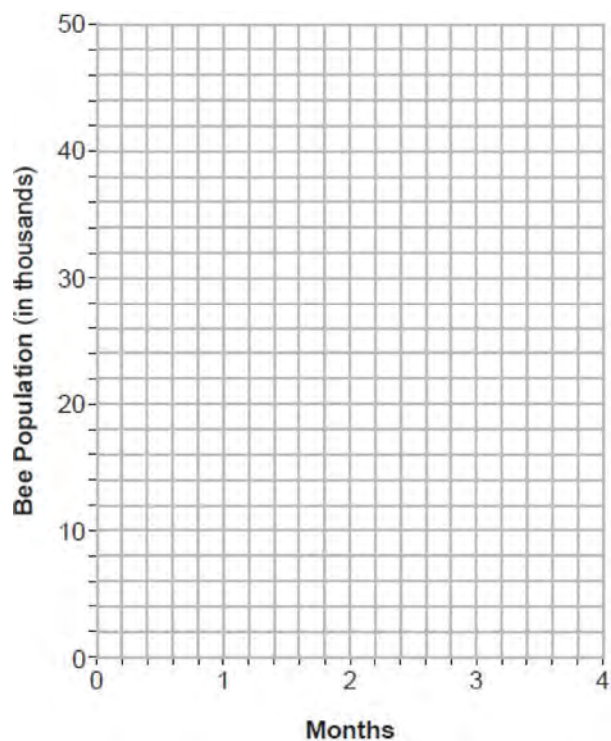
t : time in minutes that the object

cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T , after t minutes. Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes. At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F.

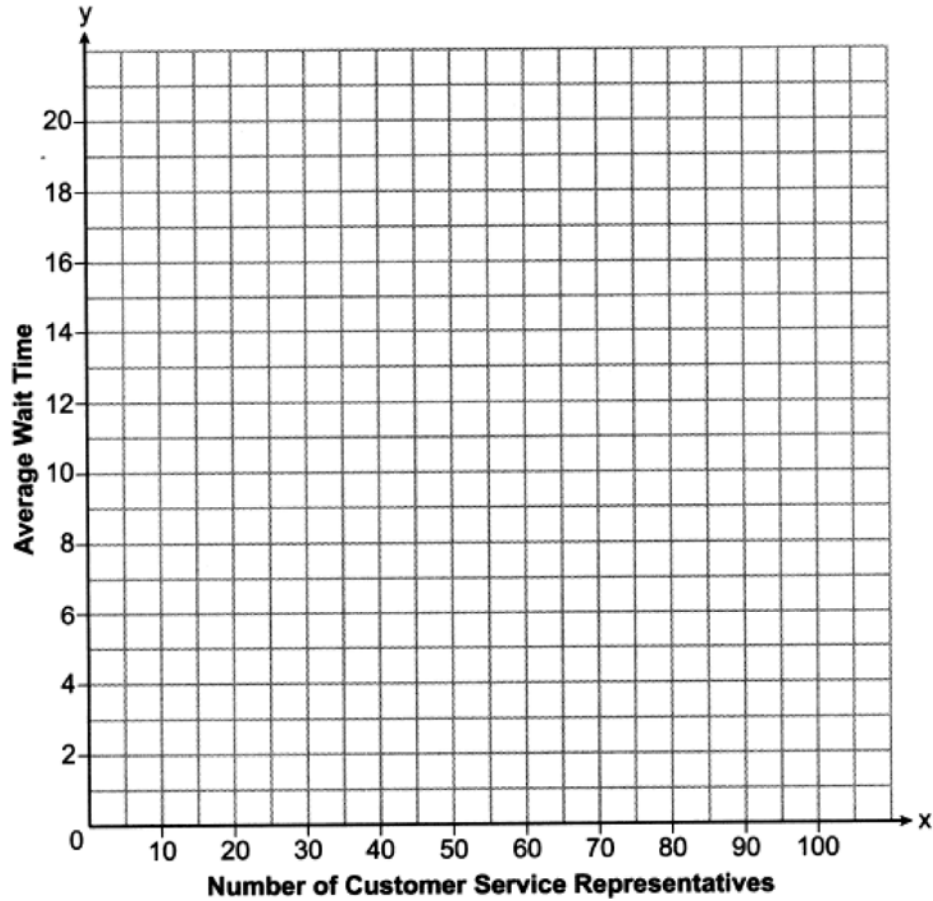
Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*. The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

466 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0 e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate. Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months. Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



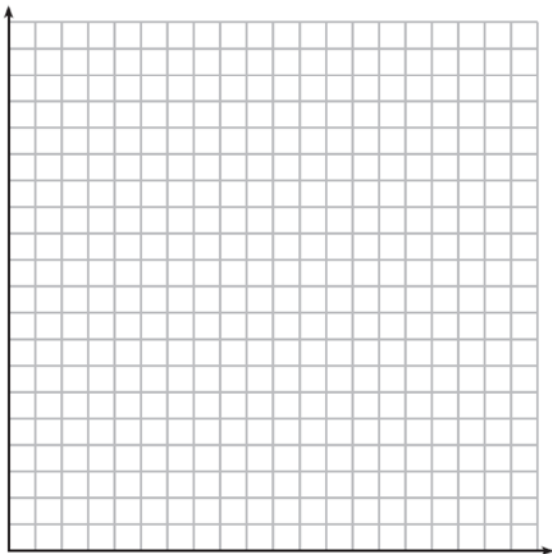
State, to the *nearest tenth of a month*, when the colonies will have the same population. Determine algebraically how long it will take, to the *nearest tenth of a month*, for the population in Colony A to triple.

- 467 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan B can be modeled by the function $B(x) = 11(0.99)^x$ where x is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer. Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.



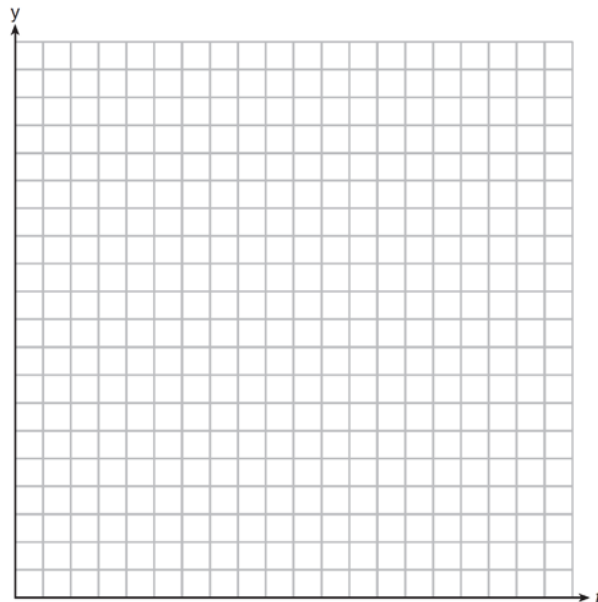
To the *nearest integer*, solve the equation $A(x) = B(x)$. Determine, to the *nearest minute*, $B(100) - A(100)$. Explain what this value represents in the given context.

- 468 The value of a certain small passenger car based on its use in years is modeled by $V(t) = 28482.698(0.684)^t$, where $V(t)$ is the value in dollars and t is the time in years. Zach had to take out a loan to purchase the small passenger car. The function $Z(t) = 22151.327(0.778)^t$, where $Z(t)$ is measured in dollars, and t is the time in years, models the unpaid amount of Zach's loan over time. Graph $V(t)$ and $Z(t)$ over the interval $0 \leq t \leq 5$, on the set of axes below.



State when $V(t) = Z(t)$, to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a \$3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

- 469 Drugs break down in the human body at different rates and therefore must be prescribed by doctors carefully to prevent complications, such as overdosing. The breakdown of a drug is represented by the function $N(t) = N_0(e)^{-rt}$, where $N(t)$ is the amount left in the body, N_0 is the initial dosage, r is the decay rate, and t is time in hours. Patient A, $A(t)$, is given 800 milligrams of a drug with a decay rate of 0.347. Patient B, $B(t)$, is given 400 milligrams of another drug with a decay rate of 0.231. Write two functions, $A(t)$ and $B(t)$, to represent the breakdown of the respective drug given to each patient. Graph each function on the set of axes below.



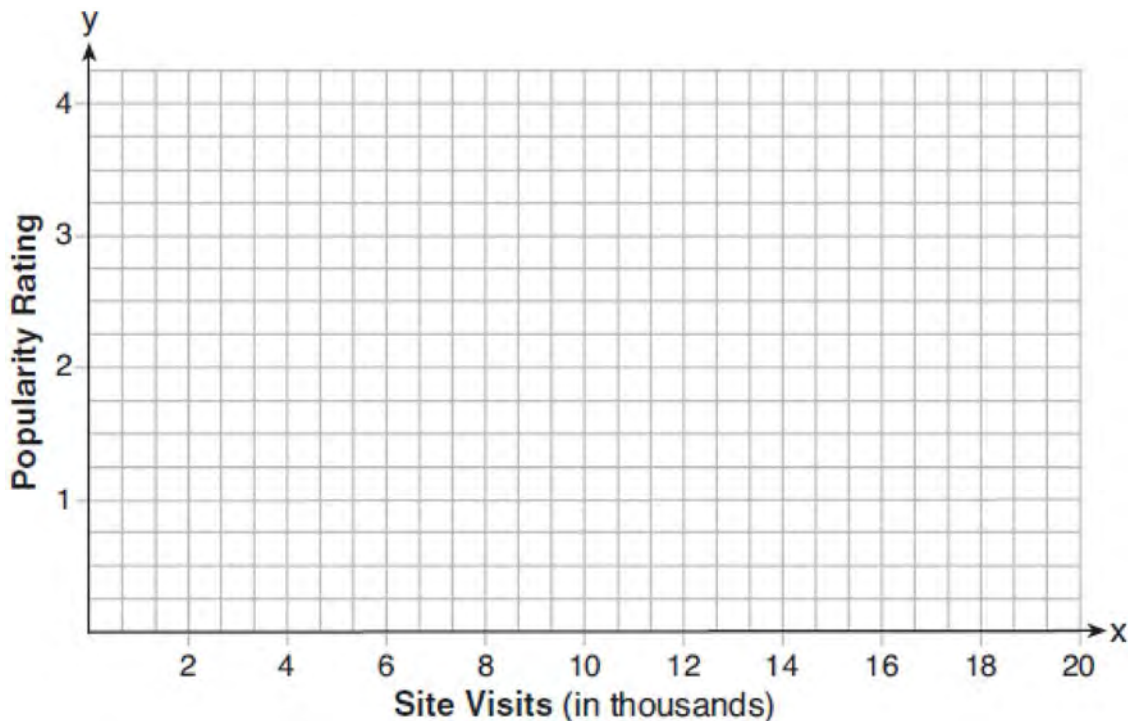
To the *nearest hour*, t , when does the amount of the given drug remaining in patient B begin to exceed the amount of the given drug remaining in patient A? The doctor will allow patient A to take another 800 milligram dose of the drug once only 15% of the original dose is left in the body. Determine, to the *nearest tenth of an hour*, how long patient A will have to wait to take another 800 milligram dose of the drug.

Algebra II Regents Exam Questions by State Standard: Topic

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- 470 After examining the functions $f(x) = \ln(x + 2)$ and $g(x) = e^{x-1}$ over the interval $(-2, 3]$, Lexi determined that the correct number of solutions to the equation $f(x) = g(x)$ is
- 1 1
 - 2 2
 - 3 3
 - 4 0
- 471 For which approximate value(s) of x will $\log(x + 5) = |x - 1| - 3$?
- 1 5, 1
 - 2 -2.41, 0.41
 - 3 -2.41, 5
 - 4 5, only
- 472 For which values of x , rounded to the *nearest hundredth*, will $|x^2 - 9| - 3 = \log_3 x$?
- 1 2.29 and 3.63
 - 2 2.37 and 3.54
 - 3 2.84 and 3.17
 - 4 2.92 and 3.06
- 473 If $p(x) = 2 \ln(x) - 1$ and $m(x) = \ln(x + 6)$, then what is the solution for $p(x) = m(x)$?
- 1 1.65
 - 2 3.14
 - 3 5.62
 - 4 no solution
- 474 Given $q(x) = 2 \log(x)$ and $r(x) = (x - 2)^3 - 4$, what is a solution of $q(x) = r(x)$ to the *nearest tenth*?
- 1 1.1
 - 2 3.7
 - 3 3.9
 - 4 4.3
- 475 If $f(x) = \frac{1}{2}x^3 + 3x^2 - 4x$ and $g(x) = 5 \log_3(x + 10)$, then which value, rounded to the *nearest tenth*, is *not* a solution to $f(x) = g(x)$?
- 1 -6.9
 - 2 -1.4
 - 3 2.2
 - 4 9.8

- 476 Website popularity ratings are often determined using models that incorporate the number of visits per week a website receives. One model for ranking websites is $P(x) = \log(x - 4)$, where x is the number of visits per week in thousands and $P(x)$ is the website's popularity rating. According to this model, if a website is visited 16,000 times in one week, what is its popularity rating, rounded to the *nearest tenth*? Graph $y = P(x)$ on the axes below.



An alternative rating model is represented by $R(x) = \frac{1}{2}x - 6$, where x is the number of visits per week in thousands. Graph $R(x)$ on the same set of axes. For what number of weekly visits will the two models provide the same rating?

- 477 What is the total number of points of intersection of the graphs of the equations $y = e^x$ and $xy = 20$?

- 1 1
- 2 2
- 3 3
- 4 0

- 479 Josie examines the graphs of $f(x) = 3^x - 8$ and

$$g(x) = \frac{1}{x^2 - 4}$$

The number of solutions to

- $f(x) = g(x)$ is
- 1 1
 - 2 2
 - 3 3
 - 4 0

- 478 How many solutions exist for

$$\frac{1}{1-x^2} = -|3x-2| + 5?$$

- 1 1
- 2 2
- 3 3
- 4 4

480 Given the functions $f(x) = 2x + \frac{5}{2}$ and $g(x) = \frac{3}{x}$,

what are the solutions to $f(x) = g(x)$?

- 1 (0.75, 4) or (-2, -1.5)
- 2 $x = 0.75$ or $x = -2$
- 3 $y = -1.5$ or $y = 4$
- 4 (-2, 0.75)

481 Which value, to the *nearest tenth*, is an approximate solution for the equation $f(x) = g(x)$,

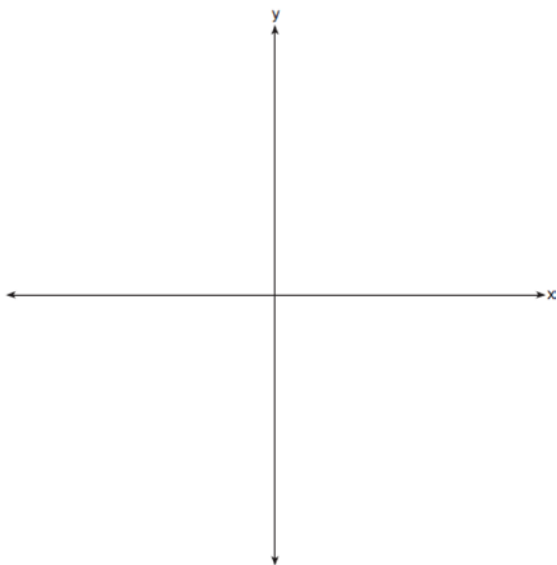
if $f(x) = \frac{5}{x-3}$ and $g(x) = 2(1.3)^x$?

- 1 3.2
- 2 3.9
- 3 4.0
- 4 5.6

482 When $g(x) = \frac{2}{x+2}$ and $h(x) = \log(x+1) + 3$ are graphed on the same set of axes, which coordinates best approximate their point of intersection?

- 1 (-0.9, 1.8)
- 2 (-0.9, 1.9)
- 3 (1.4, 3.3)
- 4 (1.4, 3.4)

483 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.



484 Sarah is fighting a sinus infection. Her doctor prescribed a nasal spray and an antibiotic to fight the infection. The active ingredients, in milligrams, remaining in the bloodstream from the nasal spray, $n(t)$, and the antibiotic, $a(t)$, are modeled in the functions below, where t is the time in hours since the medications were taken.

$$n(t) = \frac{t+1}{t+5} + \frac{18}{t^2 + 8t + 15}$$

$$a(t) = \frac{9}{t+3}$$

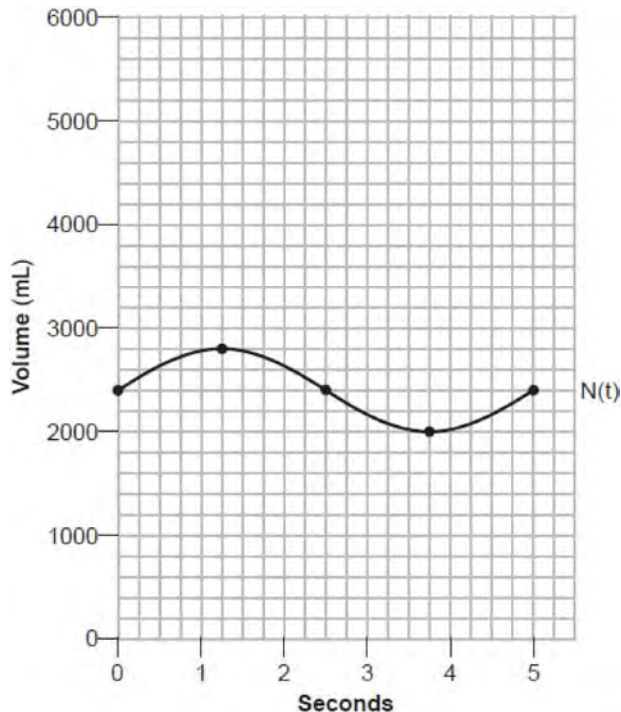
Determine which drug is made with a greater initial amount of active ingredient. Justify your answer. Sarah's doctor told her to take both drugs at the same time. Determine algebraically the number of hours after taking the medications when both medications will have the same amount of active ingredient remaining in her bloodstream.

485 Which value, to the *nearest tenth*, is the *smallest* solution of $f(x) = g(x)$ if $f(x) = 3 \sin\left(\frac{1}{2}x\right) - 1$ and

$$g(x) = x^3 - 2x + 1?$$

- 1 -3.6
- 2 -2.1
- 3 -1.8
- 4 1.4

- 486 The volume of air in an average lung during breathing can be modeled by the graph below.



Using the graph, write an equation for $N(t)$, in the form $N(t) = A \sin(Bt) + C$. That same lung, when engaged in exercise, has a volume that can be modeled by $E(t) = 2000 \sin(\pi t) + 3200$, where $E(t)$ is volume in mL and t is time in seconds. Graph *at least one* cycle of $E(t)$ on the same grid as $N(t)$. How many times during the 5-second interval will $N(t) = E(t)$?

FUNCTIONS

F.BF.A.1: OPERATIONS WITH FUNCTIONS

- 487 For all real values of x , if $f(x) = (x - 3)^2$ and $g(x) = (x + 3)^2$, what is $f(x) - g(x)$?
- 1 -18
 - 2 0
 - 3 $-12x$
 - 4 $2x^2 - 12x - 18$

- 488 Functions f and g are given below.

$$f(x) = \frac{7}{2}x^2 - 5x + 11$$

$$g(x) = 3x^2 - 7x + 25$$

When $2f(x)$ is subtracted from $g(x)$, the result is

- 1 $4x^2 - 3x - 3$
 - 2 $-4x^2 + 3x + 3$
 - 3 $4x^2 - 17x - 47$
 - 4 $-4x^2 - 17x + 47$
- 489 If $f(x) = x^2 + 9$ and $g(x) = x + 3$, which operation would not result in a polynomial expression?
- 1 $f(x) + g(x)$
 - 2 $f(x) - g(x)$
 - 3 $f(x) \cdot g(x)$
 - 4 $f(x) \div g(x)$
- 490 If $g(c) = 1 - c^2$ and $m(c) = c + 1$, then which statement is *not* true?
- 1 $g(c) \cdot m(c) = 1 + c - c^2 - c^3$
 - 2 $g(c) + m(c) = 2 + c - c^2$
 - 3 $m(c) - g(c) = c + c^2$
 - 4 $\frac{m(c)}{g(c)} = \frac{-1}{1 - c}$
- 491 If $p(x) = ab^x$ and $r(x) = cd^x$, then $p(x) \cdot r(x)$ equals
- 1 $ac(b + d)^x$
 - 2 $ac(b + d)^{2x}$
 - 3 $ac(bd)^x$
 - 4 $ac(bd)^{x^2}$
- 492 Given $x \neq 0$, where $m(x) = 12x^{8a}$ and $p(x) = 3x^{2a}$, the expression $\frac{m(x)}{p(x)}$ is equivalent to
- 1 $9x^{4a}$
 - 2 $4x^{6a}$
 - 3 $4x^6$
 - 4 $4x^4$

- 493 Given $f(x) = 2x^2 + 7x - 15$ and $g(x) = 3 - 2x$, what is $\frac{f(x)}{g(x)}$ for all defined values?
- $-x - 5$
 - $-x + 5$
 - $x - 5$
 - $x + 5$
- 494 The volume of a cardboard box can be modeled by $V(x)$, which is the product of the length, width, and height, x . If the length can be represented by $L(x) = 18 - 2x$ and the width can be represented by $W(x) = 18 - 2x$, then which function represents $V(x)$?
- $V(x) = 4x^2 - 72x + 324$
 - $V(x) = 4x^3 - 72x^2 + 324x$
 - $V(x) = -3x + 36$
 - $V(x) = 4x^3 + 324x$
- 495 Chet has \$1200 invested in a bank account modeled by the function $P(n) = 1200(1.002)^n$, where $P(n)$ is the value of his account, in dollars, after n months. Chet's debt is modeled by the function $Q(n) = 100n$, where $Q(n)$ is the value of debt, in dollars, after n months. After n months, which function represents Chet's net worth, $R(n)$?
- $R(n) = 1200(1.002)^n + 100n$
 - $R(n) = 1200(1.002)^{12n} + 100n$
 - $R(n) = 1200(1.002)^n - 100n$
 - $R(n) = 1200(1.002)^{12n} - 100n$
- 496 Stone Manufacturing has developed a cost model, $C(x) = 0.18x^3 + 0.02x^2 + 4x + 180$, where x is the number of sprockets sold, in thousands. The sales price can be modeled by $S(x) = 95.4 - 6x$ and the company's revenue by $R(x) = x \cdot S(x)$. The company's profits, $R(x) - C(x)$, could be modeled by
- $0.18x^3 + 6.02x^2 + 91.4x + 180$
 - $0.18x^3 - 5.98x^2 - 91.4x + 180$
 - $-0.18x^3 - 6.02x^2 + 91.4x - 180$
 - $0.18x^3 + 5.98x^2 + 99.4x + 180$
- 497 A manufacturing company has developed a cost model, $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$, where x is the number of items sold, in thousands. The sales price can be modeled by $S(x) = 30 - 0.01x$. Therefore, revenue is modeled by $R(x) = x \cdot S(x)$. The company's profit, $P(x) = R(x) - C(x)$, could be modeled by
- $0.15x^3 + 0.02x^2 - 28x + 120$
 - $-0.15x^3 - 0.02x^2 + 28x - 120$
 - $-0.15x^3 + 0.01x^2 - 2.01x - 120$
 - $-0.15x^3 + 32x + 120$
- 498 The profit function, $p(x)$, for a company is the cost function, $c(x)$, subtracted from the revenue function, $r(x)$. The profit function for the Acme Corporation is $p(x) = -0.5x^2 + 250x - 300$ and the revenue function is $r(x) = -0.3x^2 + 150x$. The cost function for the Acme Corporation is
- $c(x) = 0.2x^2 - 100x + 300$
 - $c(x) = 0.2x^2 + 100x + 300$
 - $c(x) = -0.2x^2 + 100x - 300$
 - $c(x) = -0.8x^2 + 400x - 300$
- 499 The profit function, $p(x)$, is found by subtracting the cost function, $c(x)$, from the revenue function, $r(x)$. Which function below represents the cost function given $p(x) = -15x^2 + 600x + 60$ and $r(x) = -0.4x^2 + 130x + 1200$?
- $c(x) = -14.6x^2 + 470x - 1140$
 - $c(x) = -14.6x^2 + 730x - 1260$
 - $c(x) = 14.6x^2 - 470x + 1140$
 - $c(x) = 14.6x^2 + 730x - 1260$
- 500 Given: $f(x) = 2x^2 + x - 3$ and $g(x) = x - 1$
Express $f(x) \cdot g(x) - [f(x) + g(x)]$ as a polynomial in standard form.

- 501 Write the expression $A(x) \cdot B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$

$$B(x) = x^2 + 7$$

$$C(x) = x^4 - 5x$$

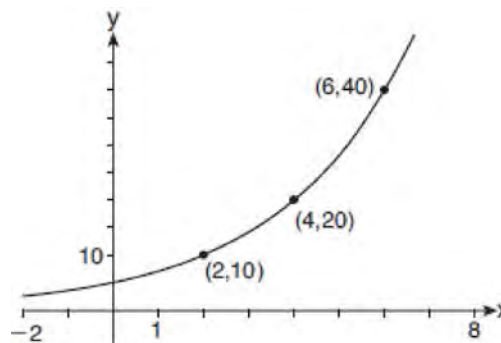
- 502 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \cdot d(x) - [d(x)]^3$ as a polynomial in standard form.

- 503 Given: $f(x) = 5x^2 + 3x - 12$ and $g(x) = 2x - 1$. Express $4g(x) - [f(x + 1)]$ as a polynomial in standard form.

F.LE.A.2: FAMILIES OF FUNCTIONS

- 504 Perry invested in property that cost him \$1500. Five years later it was worth \$3000, and 10 years from his original purchase, it was worth \$6000. Assuming the growth rate remains the same, which type of function could he create to find the value of his investment 30 years from his original purchase?
- 1 exponential function
 - 2 linear function
 - 3 quadratic function
 - 4 trigonometric function

- 505 The graph of $y = f(x)$ is shown below.



Which expression defines $f(x)$?

- 1 $2x$
- 2 $5(2^x)$
- 3 $5(2^{\frac{x}{2}})$
- 4 $5(2^{2x})$

506 Which table best represents an exponential relationship?

1

x	y
1	8
2	4
3	2
4	1
5	$\frac{1}{2}$

2

x	y
8	0
4	1
0	2
-4	3
-8	4

3

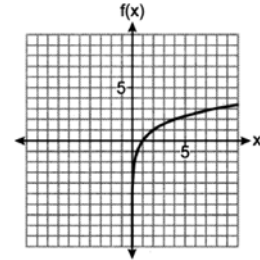
x	y
0	0
1	1
2	4
3	9
4	16

4

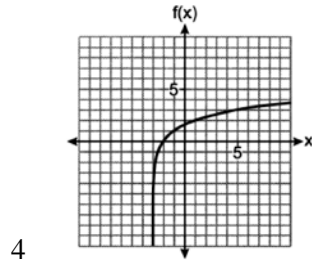
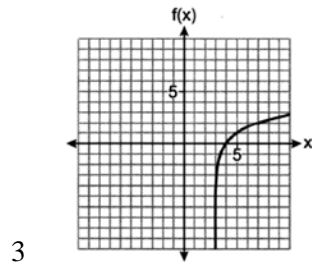
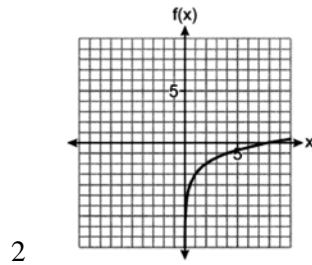
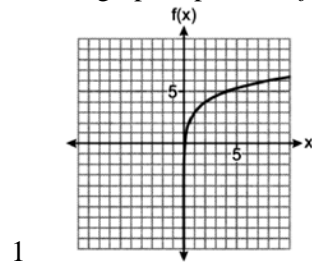
x	y
1	1
2	8
3	27
4	64
5	125

F.BF.B.3: TRANSFORMATIONS WITH FUNCTIONS

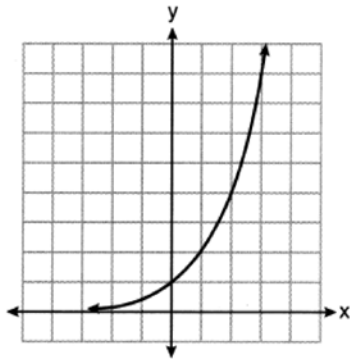
507 The graph of $f(x)$ is shown below.



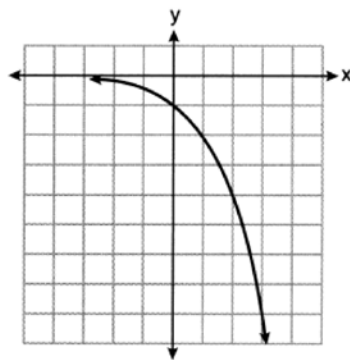
Which graph represents $f(x + 3)$?



508 Consider the function $y = h(x)$, defined by the graph below.

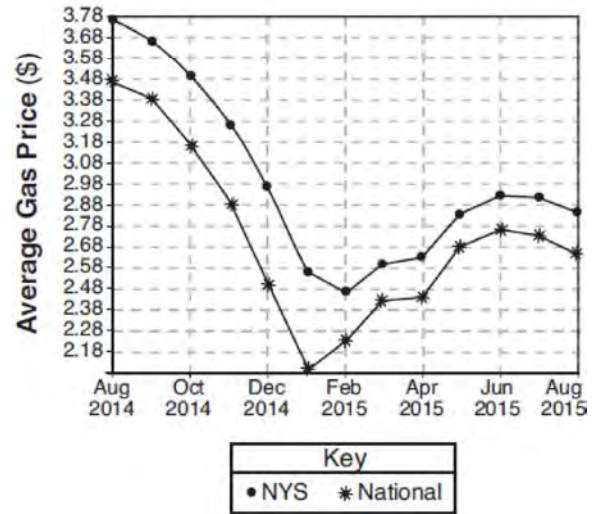


Which equation could be used to represent the graph shown below?



- 1 $y = h(x) - 2$
- 2 $y = h(x - 2)$
- 3 $y = -h(x)$
- 4 $y = h(-x)$

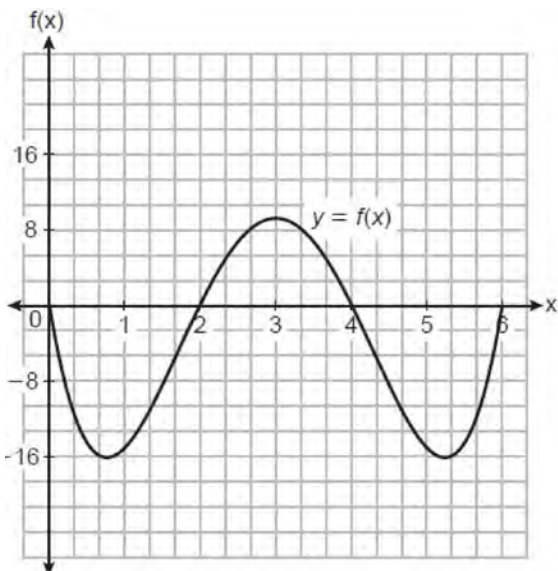
509 The graph below represents national and New York State average gas prices.



If New York State's gas prices are modeled by $G(x)$ and $C > 0$, which expression best approximates the national average x months from August 2014?

- 1 $G(x + C)$
- 2 $G(x) + C$
- 3 $G(x - C)$
- 4 $G(x) - C$

- 510 The height of a running trail is modeled by the quartic function $y = f(x)$ shown below, where x is the distance in miles from the start of the trail and y is the height in feet relative to sea level.



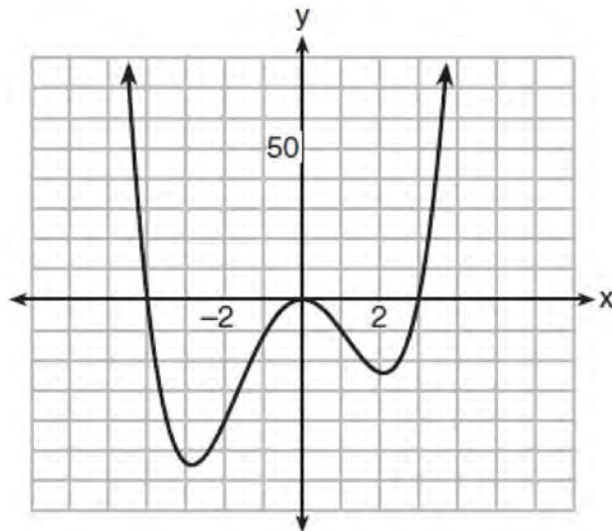
If this trail has a minimum height of 16 feet below sea level, which function(s) could represent a running trail whose minimum height is half of the minimum height of the original trail?

I. $y = f\left(\frac{1}{2}x\right)$ II. $y = f(x) + 8$ III. $y = \frac{1}{2}f(x)$

- 1 I, only
 - 2 II, only
 - 3 I and III
 - 4 II and III
- 511 The point $(2, -3)$ lies on the graph of the equation $y = f(x)$. Which point must lie on the graph of the equation $y = f(x - 4) + 1$?

- 1 $(1, 1)$
- 2 $(-2, -2)$
- 3 $(3, -7)$
- 4 $(6, -2)$

- 512 The graph of $y = f(x)$ is shown below. The function has a leading coefficient of 1.



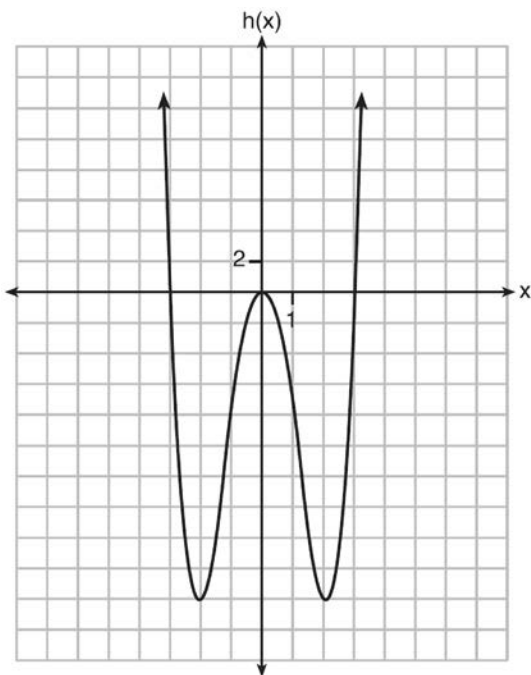
Write an equation for $f(x)$. The function g is formed by translating function f left 2 units. Write an equation for $g(x)$.

F.BF.B.3: EVEN AND ODD FUNCTIONS

513 Functions f , g , and h are given below.

$$f(x) = \sin(2x)$$

$$g(x) = f(x) + 1$$



Which statement is true about functions f , g , and h ?

- 1 $f(x)$ and $g(x)$ are odd, $h(x)$ is even.
- 2 $f(x)$ and $g(x)$ are even, $h(x)$ is odd.
- 3 $f(x)$ is odd, $g(x)$ is neither, $h(x)$ is even.
- 4 $f(x)$ is even, $g(x)$ is neither, $h(x)$ is odd.

514 Which function is even?

- 1 $f(x) = \sin x$
- 2 $f(x) = x^2 - 4$
- 3 $f(x) = |x - 2| + 5$
- 4 $f(x) = x^4 + 3x^3 + 4$

515 Which function is even?

- 1 $f(x) = x^3 + 2$
- 2 $f(x) = x^2 + 1$
- 3 $f(x) = |x + 2|$
- 4 $f(x) = \sin(2x)$

516 Which equation represents an odd function?

- 1 $y = \sin x$
- 2 $y = \cos x$
- 3 $y = (x + 1)^3$
- 4 $y = e^{5x}$

517 If $f(x)$ is an even function, which function must also be even?

- 1 $f(x - 2)$
- 2 $f(x) + 3$
- 3 $f(x + 1)$
- 4 $f(x + 1) + 3$

518 For $f(x) = \cos x$, which statement is true?

- 1 $2f(x)$ and $f(2x)$ are even functions.
- 2 $f(2x)$ and $f(x) + 2$ are odd functions.
- 3 $2f(x)$ and $f\left(x + \frac{\pi}{2}\right)$ are odd functions.
- 4 $f(x) + 2$ is an odd function and $f\left(x + \frac{\pi}{2}\right)$ is an even function.

519 Can $f(x) = x^3 + 7$ be classified as an odd function? Justify your answer.

F.BF.B.4: INVERSE OF FUNCTIONS

520 What is the inverse of $f(x) = -6(x - 2)$?

- 1 $f^{-1}(x) = -2 - \frac{x}{6}$
- 2 $f^{-1}(x) = 2 - \frac{x}{6}$
- 3 $f^{-1}(x) = \frac{1}{-6(x - 2)}$
- 4 $f^{-1}(x) = 6(x + 2)$

521 Given $f(x) = \frac{1}{2}x + 8$, which equation represents the inverse, $g(x)$?

- 1 $g(x) = 2x - 8$
- 2 $g(x) = 2x - 16$
- 3 $g(x) = -\frac{1}{2}x + 8$
- 4 $g(x) = -\frac{1}{2}x - 16$

522 What is the inverse of the function $y = 4x + 5$?

- 1 $x = \frac{1}{4}y - \frac{5}{4}$
- 2 $y = \frac{1}{4}x - \frac{5}{4}$
- 3 $y = 4x - 5$
- 4 $y = \frac{1}{4x + 5}$

523 The inverse of $f(x) = -6x + \frac{1}{2}$ is

- 1 $f^{-1}(x) = 6x - \frac{1}{2}$
- 2 $f^{-1}(x) = \frac{1}{-6x + \frac{1}{2}}$
- 3 $f^{-1}(x) = -\frac{1}{6}x + \frac{1}{12}$
- 4 $f^{-1}(x) = -\frac{1}{6}x + 2$

524 If $f(x) = \frac{1}{2}x + 2$, then the inverse function is

- 1 $f^{-1}(x) = -\frac{1}{2}x - 2$
- 2 $f^{-1}(x) = \frac{1}{2}x - 1$
- 3 $f^{-1}(x) = 2x - 4$
- 4 $f^{-1}(x) = 2x + 2$

525 If $f(x) = 12x - 4$, then the inverse function $f^{-1}(x)$ is

- 1 $f^{-1}(x) = \frac{x+1}{3}$
- 2 $f^{-1}(x) = \frac{x}{3} + 1$
- 3 $f^{-1}(x) = \frac{x+4}{12}$
- 4 $f^{-1}(x) = \frac{x}{12} + 4$

526 What is the inverse of $f(x) = 2x + 6$?

- 1 $f^{-1}(x) = -2(x + 3)$
- 2 $f^{-1}(x) = x - 3$
- 3 $f^{-1}(x) = \frac{x}{2} - 3$
- 4 $f^{-1}(x) = \frac{x}{2} + 3$

527 Given $f^{-1}(x) = -\frac{3}{4}x + 2$, which equation represents $f(x)$?

- 1 $f(x) = \frac{4}{3}x - \frac{8}{3}$
- 2 $f(x) = -\frac{4}{3}x + \frac{8}{3}$
- 3 $f(x) = \frac{3}{4}x - 2$
- 4 $f(x) = -\frac{3}{4}x + 2$

528 Given the inverse function $f^{-1}(x) = \frac{2}{3}x + \frac{1}{6}$, which function represents $f(x)$?

- 1 $f(x) = -\frac{2}{3}x + \frac{1}{6}$
- 2 $f(x) = -\frac{3}{2}x + \frac{1}{4}$
- 3 $f(x) = \frac{3}{2}x - \frac{1}{4}$
- 4 $f(x) = \frac{3}{2}x - \frac{1}{6}$

529 Given $f(x) = -\frac{2}{5}x + 4$, which statement is true of the inverse function $f^{-1}(x)$?

- 1 $f^{-1}(x)$ is a line with slope $\frac{5}{2}$.
- 2 $f^{-1}(x)$ is a line with slope $\frac{2}{5}$.
- 3 $f^{-1}(x)$ passes through the point $(6, -5)$.
- 4 $f^{-1}(x)$ has a y-intercept at $(0, -4)$.

530 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

531 What is the inverse of $f(x) = x^3 - 2$?

- 1 $f^{-1}(x) = \sqrt[3]{x} + 2$
- 2 $f^{-1}(x) = \pm\sqrt[3]{x} + 2$
- 3 $f^{-1}(x) = \sqrt[3]{x+2}$
- 4 $f^{-1}(x) = \pm\sqrt[3]{x+2}$

532 Given $f(x) = x^3 - 3$ and $f^{-1}(x) = \sqrt[3]{x - 3b}$, the value of b is

- 1 1
- 2 -1
- 3 3
- 4 -3

533 For the function $d(x) = \sqrt[3]{x+2}$, the inverse function, $d^{-1}(x)$, equals

- 1 $\sqrt[3]{x+2}$
- 2 $x^3 + 2$
- 3 $-\sqrt[3]{x+2}$
- 4 $x^3 - 2$

534 If $f(x) = \sqrt[3]{x} + 4$, then $f^{-1}(x)$ equals

- 1 $\sqrt[3]{x-4}$
- 2 $(x-4)^3$
- 3 $x^3 + \frac{1}{4}$
- 4 $-\sqrt[3]{x-4}$

535 For the function $f(x) = (x-3)^3 + 1$, find $f^{-1}(x)$.

536 The inverse of the function $f(x) = \frac{x+1}{x-2}$ is

- 1 $f^{-1}(x) = \frac{x+1}{x+2}$
- 2 $f^{-1}(x) = \frac{2x+1}{x-1}$
- 3 $f^{-1}(x) = \frac{x+1}{x-2}$
- 4 $f^{-1}(x) = \frac{x-1}{x+1}$

537 What is the inverse of $f(x) = \frac{x}{x+2}$, where $x \neq -2$?

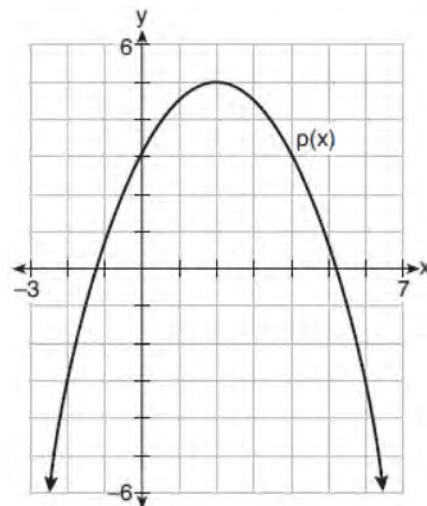
- 1 $f^{-1}(x) = \frac{2x}{x-1}$
- 2 $f^{-1}(x) = \frac{-2x}{x-1}$
- 3 $f^{-1}(x) = \frac{x}{x-2}$
- 4 $f^{-1}(x) = \frac{-x}{x-2}$

F.IF.C.9: COMPARING FUNCTIONS

538 Which function has the greatest y-intercept?

- 1 $f(x) = 4 \sin(2x)$
- 2 $g(x) = 3x^4 + 2x^3 + 7$
- 3 $h(x) = 5e^{2x} + 3$
- 4 $j(x) = 6 \log_2(3x+4)$

539 Consider $f(x) = 4x^2 + 6x - 3$, and $p(x)$ defined by the graph below.



The difference between the values of the maximum of p and minimum of f is

- 1 0.25
- 2 1.25
- 3 3.25
- 4 10.25

540 Consider $f(x) = (x - 2)^2(x + 3)$, and $g(x)$ as strictly defined in the table below.

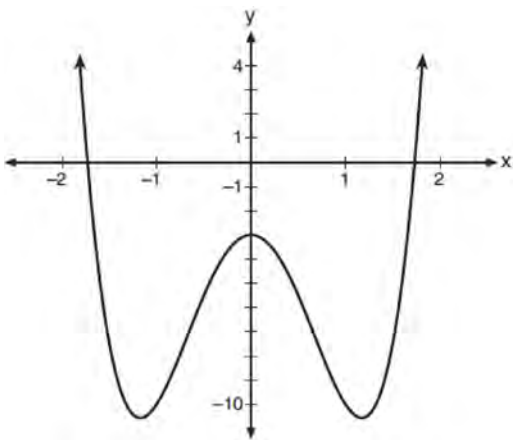
x	$g(x)$
-3	0
-2	1
-1	-2
0	-6
1	-1
2	0

Which statement or statements must be true, based on the information given?

- I. Both $f(x)$ and $g(x)$ have the same x -intercepts.
- II. Both $f(x)$ and $g(x)$ have a y -intercept at $y = -6$.

- 1 I, only
- 2 II, only
- 3 I and III
- 4 neither I nor II

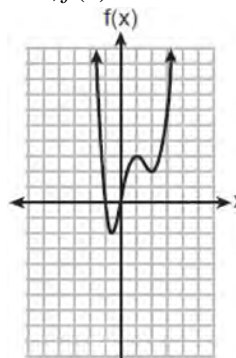
541 Consider the function $p(x) = 3x^3 + x^2 - 5x$ and the graph of $y = m(x)$ below.



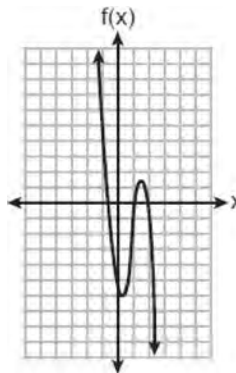
Which statement is true?

- 1 $p(x)$ has three real roots and $m(x)$ has two real roots.
- 2 $p(x)$ has one real root and $m(x)$ has two real roots.
- 3 $p(x)$ has two real roots and $m(x)$ has three real roots.
- 4 $p(x)$ has three real roots and $m(x)$ has four real roots.

542 Which function has the characteristic as $x \rightarrow -\infty, f(x) \rightarrow -\infty$?



1



2

3 $f(x) = 5(4)^{-x}$

4 $f(x) = -\log_5(-x)$

543 The x -value of which function's x -intercept is larger, f or h ? Justify your answer.

$$f(x) = \log(x - 4)$$

x	$h(x)$
-1	6
0	4
1	2
2	0
3	-2

544 Consider the function $h(x) = 2 \sin(3x) + 1$ and the function q represented in the table below.

x	$q(x)$
-2	-8
-1	0
0	0
1	-2
2	0

Determine which function has the *smaller* minimum value for the domain $[-2, 2]$. Justify your answer.

545 Which statement regarding the graphs of the functions below is *untrue*?

$$f(x) = 3 \sin 2x, \text{ from } -\pi < x < \pi$$

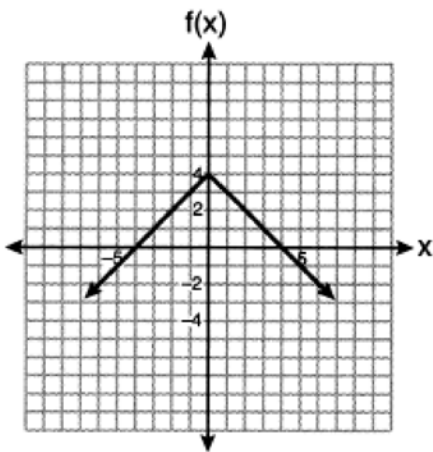
$$g(x) = (x - 0.5)(x + 4)(x - 2)$$

$$h(x) = \log_2 x$$

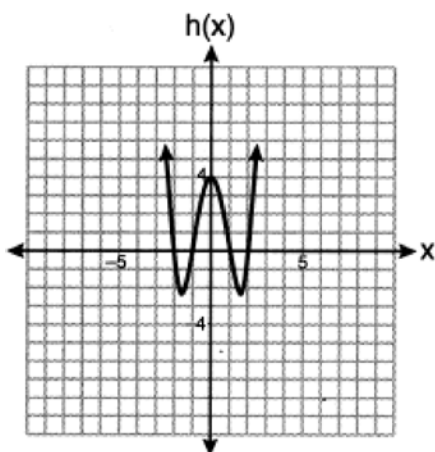
$$j(x) = -|4x - 2| + 3$$

- 1 $f(x)$ and $j(x)$ have a maximum y -value of 3.
- 2 $f(x)$, $h(x)$, and $j(x)$ have one y -intercept.
- 3 $g(x)$ and $j(x)$ have the same end behavior as $x \rightarrow -\infty$.
- 4 $g(x)$, $h(x)$, and $j(x)$ have rational zeros.

- 546 Which function has a maximum y-value of 4 and a midline of $y = 1$?



- 1
 2 $g(x) = -3 \cos(x) + 1$



- 3
 4 $j(x) = 4 \sin(x) + 1$

SEQUENCES & SERIES

F.IF.A.3: SEQUENCES

- 547 Consider the following patterns:

- I. $16, -12, 9, -6.75, \dots$
 II. $1, 4, 9, 16, \dots$
 III. $6, 18, 30, 42, \dots$
 IV. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots$

Which pattern is geometric?

- 1 I
 2 II
 3 III
 4 IV

- 548 Which sequence has a common ratio of $\frac{1}{2}$?

- 1 $-\frac{1}{4}a, -\frac{1}{8}a, -\frac{1}{16}a, -\frac{1}{32}a, \dots$
 2 $\frac{1}{32}a, \frac{1}{16}a, \frac{1}{8}a, \frac{1}{4}a, \dots$
 3 $20a, \frac{39}{2}a, 19a, \frac{37}{2}a, \dots$
 4 $22a, 22.5a, 23a, 23.5a, \dots$

- 549 Which situation could be modeled using a geometric sequence?

- 1 A cell phone company charges \$30.00 per month for 2 gigabytes of data and \$12.50 for each additional gigabyte of data.
 2 The temperature in your car is 79° . You lower the temperature of your air conditioning by 2° every 3 minutes in order to find a comfortable temperature.
 3 David's parents have set a limit of 50 minutes per week that he may play online games during the school year. However, they will increase his time by 5% per week for the next ten weeks.
 4 Sarah has \$100.00 in her piggy bank and saves an additional \$15.00 each week.

- 550 A function is defined as $a_n = a_{n-1} + \log_{n+1}(n-1)$, where $a_1 = 8$. What is the value of a_3 ?

- 1 8
 2 8.5
 3 9.2
 4 10

- 551 The recursive formula to describe a sequence is shown below.

$$a_1 = 3$$

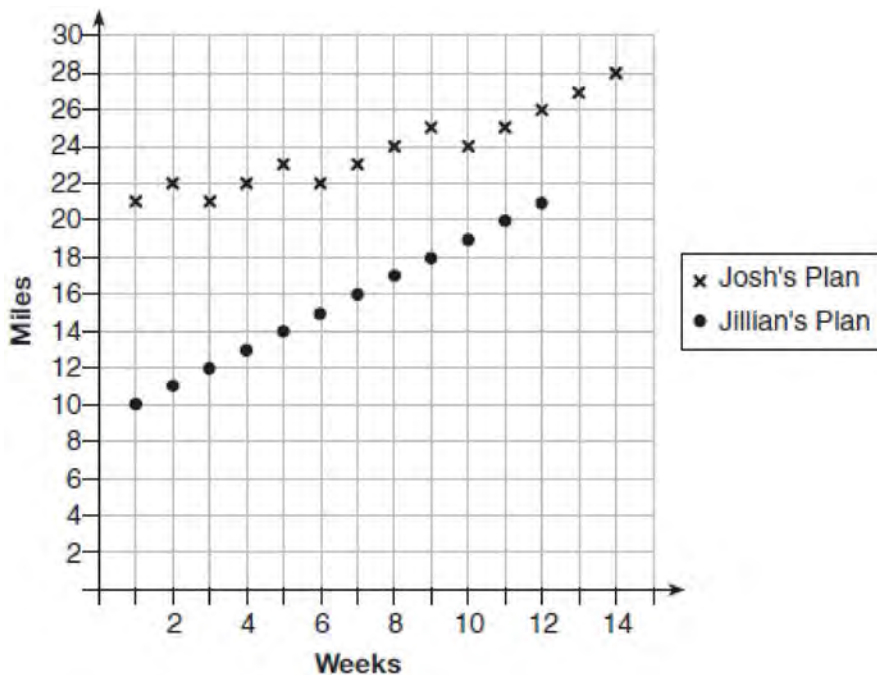
$$a_n = 1 + 2a_{n-1}$$

State the first four terms of this sequence. Can this sequence be represented using an explicit geometric formula? Justify your answer.

F.BF.A.2: SEQUENCES

- 552 What is the seventh term of the sequence $-2, 6, -18, 54, \dots$?
- 1 -1458
 - 2 -4374
 - 3 1458
 - 4 4374
- 553 The seventh term of the geometric sequence $\sqrt{6}, -2\sqrt{3}, 2\sqrt{6}, -4\sqrt{3}, \dots$ is
- 1 $6\sqrt{6}$
 - 2 $-6\sqrt{3}$
 - 3 $8\sqrt{6}$
 - 4 $-8\sqrt{3}$
- 554 The eighth and tenth terms of a sequence are 64 and 100. If the sequence is either arithmetic or geometric, the ninth term can *not* be
- 1 -82
 - 2 -80
 - 3 80
 - 4 82
- 555 When a ball bounces, the heights of consecutive bounces form a geometric sequence. The height of the first bounce is 121 centimeters and the height of the third bounce is 64 centimeters. To the *nearest centimeter*, what is the height of the fifth bounce?
- 1 25
 - 2 34
 - 3 36
 - 4 42
- 556 Simon lost his library card and has an overdue library book. When the book was 5 days late, he owed \$2.25 to replace his library card and pay the fine for the overdue book. When the book was 21 days late, he owed \$6.25 to replace his library card and pay the fine for the overdue book. Suppose the total amount Simon owes when the book is n days late can be determined by an arithmetic sequence. Determine a formula for a_n , the n th term of this sequence. Use the formula to determine the amount of money, in dollars, Simon needs to pay when the book is 60 days late.
- 557 Savannah just got contact lenses. Her doctor said she can wear them 2 hours the first day, and can then increase the length of time by 30 minutes each day. If this pattern continues, which formula would *not* be appropriate to determine the length of time, in either minutes or hours, she could wear her contact lenses on the n th day?
- 1 $a_1 = 120$
 - 2 $a_n = a_{n-1} + 30$
 - 3 $a_n = 90 + 30n$
 - 4 $a_1 = 2$
 - 5 $a_n = a_{n-1} + 0.5$
 - 6 $a_n = 2.5 + 0.5n$
- 558 At her job, Pat earns \$25,000 the first year and receives a raise of \$1000 each year. The explicit formula for the n th term of this sequence is $a_n = 25,000 + (n - 1)1000$. Which rule best represents the equivalent recursive formula?
- 1 $a_n = 24,000 + 1000n$
 - 2 $a_n = 25,000 + 1000n$
 - 3 $a_1 = 25,000, a_n = a_{n-1} + 1000$
 - 4 $a_1 = 25,000, a_n = a_{n+1} + 1000$
- 559 The explicit formula $a_n = 6 + 6n$ represents the number of seats in each row in a movie theater, where n represents the row number. Rewrite this formula in recursive form.

- 560 Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer. Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose. Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

- 561 A recursive formula for the sequence 18, 9, 4.5, ... is

1 $g_1 = 18$

$$g_n = \frac{1}{2}g_{n-1}$$

2 $g_n = 18\left(\frac{1}{2}\right)^{n-1}$

3 $g_1 = 18$

$$g_n = 2g_{n-1}$$

4 $g_n = 18(2)^{n-1}$

- 562 A recursive formula for the sequence 40, 30, 22.5, ... is

1 $g_n = 40\left(\frac{3}{4}\right)^n$

2 $g_1 = 40$

$$g_n = g_{n-1} - 10$$

3 $g_n = 40\left(\frac{3}{4}\right)^{n-1}$

4 $g_1 = 40$

$$g_n = \frac{3}{4}g_{n-1}$$

Algebra II Regents Exam Questions by State Standard: Topic

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563 A recursive formula for the sequence 64, 48, 36, ... is

1 $a_n = 64(0.75)^{n-1}$

2 $a_1 = 64$

$a_n = a_{n-1} - 16$

3 $a_n = 64 + (n-1)(-16)$

4 $a_1 = 64$

$a_n = 0.75a_{n-1}$

564 The sequence $a_1 = 6, a_n = 3a_{n-1}$ can also be written as

1 $a_n = 6 \cdot 3^n$

2 $a_n = 6 \cdot 3^{n+1}$

3 $a_n = 2 \cdot 3^n$

4 $a_n = 2 \cdot 3^{n+1}$

565 Consider the recursively defined sequence below.

$$a_1 = 8$$

$$a_n = 2a_{n-1}$$

Which explicit formula represents the same sequence?

1 $a_n = 2^n$

2 $a_n = 2(4^n)$

3 $a_n = 2^{n+2}$

4 $a_n = 8^n$

568 After Roger's surgery, his doctor administered pain medication in the following amounts in milligrams over four days.

Day (n)	1	2	3	4
Dosage (m)	2000	1680	1411.2	1185.4

How can this sequence best be modeled recursively?

1 $m_1 = 2000$

$m_n = m_{n-1} - 320$

2 $m_n = 2000(0.84)^{n-1}$

3 $m_1 = 2000$

$m_n = (0.84)m_{n-1}$

4 $m_n = 2000(0.84)^{n+1}$

566 An initial investment of \$5000 in an account earns 3.5% annual interest. Which function correctly represents a recursive model of the investment after n years?

1 $A = 5000(0.035)^n$

2 $a_0 = 5000$

$a_n = a_{n-1}(0.035)$

3 $A = 5000(1.035)^n$

4 $a_0 = 5000$

$a_n = a_{n-1}(1.035)$

567 The population of Jamesburg for the years 2010-2013, respectively, was reported as follows: 250,000 250,937 251,878 252,822

How can this sequence be recursively modeled?

1 $j_n = 250,000(1.00375)^{n-1}$

2 $j_n = 250,000 + 937^{(n-1)}$

3 $j_1 = 250,000$

$j_n = 1.00375j_{n-1}$

4 $j_1 = 250,000$

$j_n = j_{n-1} + 937$

569 In 2010, the population of New York State was approximately 19,378,000 with an annual growth rate of 1.5%. Assuming the growth rate is maintained for a large number of years, which equation can be used to predict the population of New York State t years after 2010?

1 $P_t = 19,378,000(1.5)^t$

2 $P_0 = 19,378,000$

$P_t = 19,378,000 + 1.015P_{t-1}$

3 $P_t = 19,378,000(1.015)^{t-1}$

4 $P_0 = 19,378,000$

$P_t = 1.015P_{t-1}$

570 The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of \$75,000, which model is a recursive formula representing the value of the boat n years after it was purchased?

1 $a_n = 75,000(0.08)^n$

2 $a_0 = 75,000$

$a_n = (0.92)^n$

3 $a_n = 75,000(1.08)^n$

4 $a_0 = 75,000$

$a_n = 0.92(a_{n-1})$

571 A vehicle's depreciation rate is 9.2% per year. If a vehicle costs \$34,950, then which recursive formula models the value of the vehicle n years after it was purchased?

1 $a_n = 34,950(1.092)^n$

2 $a_n = 34,950(0.921)^n$

3 $a_0 = 34,950$

$a_n = 1.092a_{n-1}$

4 $a_0 = 34,950$

$a_n = 0.908a_{n-1}$

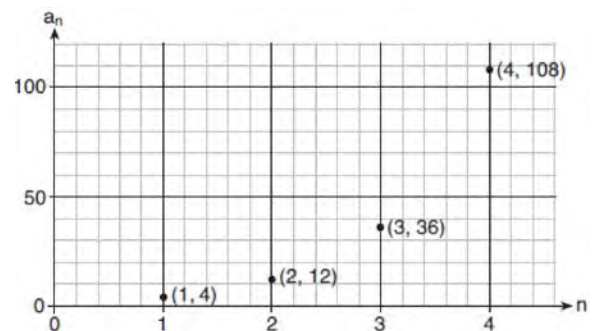
572 The formula below can be used to model which scenario?

$$a_1 = 3000$$

$$a_n = 0.80a_{n-1}$$

- The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.
- The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.
- A bank account starts with a deposit of \$3000, and each year it grows by 80%.
- The initial value of a specialty toy is \$3000, and its value each of the following years is 20% less.

573 Write a recursive formula, a_n , to describe the sequence graphed below.



574 Write a recursive formula for the sequence 6, 9, 13.5, 20.25, ...

575 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5, ...

576 Write a recursive formula for the sequence 189, 63, 21, 7, ...

577 Write an explicit formula for a_n , the n th term of the recursively defined sequence below.

$$a_1 = x + 1$$

$$a_n = x(a_{n-1})$$

For what values of x would $a_n = 0$ when $n > 1$?

- 578 The population, in millions of people, of the United States can be represented by the recursive formula below, where a_0 represents the population in 1910 and n represents the number of years since 1910.

$$a_0 = 92.2$$

$$a_n = 1.015a_{n-1}$$

Identify the percentage of the annual rate of growth from the equation $a_n = 1.015a_{n-1}$. Write an exponential function, P , where $P(t)$ represents the United States population in millions of people, and t is the number of years since 1910. According to this model, determine algebraically the number of years it takes for the population of the United States to be approximately 300 million people. Round your answer to the *nearest year*.

F.BF.B.6: SIGMA NOTATION

- 579 Kristin wants to increase her running endurance. According to experts, a gradual mileage increase of 10% per week can reduce the risk of injury. If Kristin runs 8 miles in week one, which expression can help her find the total number of miles she will have run over the course of her 6-week training program?

1 $\sum_{n=1}^6 8(1.10)^{n-1}$

2 $\sum_{n=1}^6 8(1.10)^n$

3 $\frac{8 - 8(1.10)^6}{0.90}$

4 $\frac{8 - 8(0.10)^n}{1.10}$

- 580 A company fired several employees in order to save money. The amount of money the company saved per year over five years following the loss of employees is shown in the table below.

Year	Amount Saved (in dollars)
1	59,000
2	64,900
3	71,390
4	78,529
5	86,381.9

Which expression determines the total amount of money saved by the company over 5 years?

1 $\frac{59,000 - 59,000(1.1)^5}{1 - 1.1}$

2 $\frac{59,000 - 59,000(0.1)^5}{1 - 0.1}$

3 $\sum_{n=1}^5 59,000(1.1)^n$

4 $\sum_{n=1}^5 59,000(0.1)^{n-1}$

F.BF.B.7: SERIES

- 581 Jake wants to buy a car and hopes to save at least \$5000 for a down payment. The table below summarizes the amount of money he plans to save each week.

Week	1	2	3	4	5
Money Saved, in Dollars	2	5	12.5	31.25	...

Based on this plan, which expression should he use to determine how much he has saved in n weeks?

- 1 $\frac{2 - 2(2.5^n)}{1 - 2.5}$ 3 $\frac{1 - 2.5^n}{1 - 2.5}$
 2 $\frac{2 - 2(2.5^{n-1})}{1 - 2.5}$ 4 $\frac{1 - 2.5^{n-1}}{1 - 2.5}$

- 582 Beginning July 1, 2019, Michelle deposited \$250 into an account that yields 0.15% each month. She continued to make \$250 deposits into this account on the first of each month for 3 years. Which expression represents the amount of money that was in the account after her last deposit was made on June 1, 2022?

- 1 $250(1.0015)^3$
 2 $250(1.0015)^{36}$
 3 $\frac{250 - 250(1.0015)^3}{1 - 1.0015}$
 4 $\frac{250 - 250(1.0015)^{36}}{1 - 1.0015}$

- 583 John and Margaret deposit \$500 into a savings account for their son on his first birthday. They continue to make a deposit of \$500 on the child's birthday, with the last deposit being made on the child's 21st birthday. If the account pays 4% annual interest, which equation represents the amount of money in the account after the last deposit is made?

- 1 $S_{21} = 500(1.04)^{21}$
 2 $S_{21} = \frac{500(1 - 1.04^{21})}{1 - 1.04}$
 3 $S_{21} = 500(1.04)^{20} + 500$
 4 $S_{21} = \frac{500(1 - 0.04^{21})}{1 - 1.04}$

- 584 Jasmine decides to put \$100 in a savings account each month. The account pays 3% annual interest, compounded monthly. How much money, S , will Jasmine have after one year?

- 1 $S = 100(1.03)^{12}$
 2 $S = \frac{100 - 100(1.0025)^{12}}{1 - 1.0025}$
 3 $S = 100(1.0025)^{12}$
 4 $S = \frac{100 - 100(1.03)^{12}}{1 - 1.03}$

- 585 The sum of the first 20 terms of the series $-2 + 6 - 18 + 54 - \dots$ is

- 1 -610
 2 -59
 3 $1,743,392,200$
 4 $2,324,522,934$

- 586 The first term of a geometric sequence is 8 and the fourth term is 216. What is the sum of the first 12 terms of the corresponding series?

- 1 $236,192$
 2 $708,584$
 3 $2,125,760$
 4 $6,377,288$

- 587 A ball is dropped from a height of 32 feet. It bounces and rebounds 80% of the height from which it was falling. What is the total downward distance, in feet, the ball traveled up to the 12th bounce?
- 1 29
 - 2 58
 - 3 120
 - 4 149
- 588 Jay is training for a bike race over fifteen weeks. At the end of the first week, he has ridden ten miles, and he is planning to increase his weekly distance by nine percent each week. Approximately how many miles total will he have ridden from the beginning of his training to the end of the fifteenth week?
- 1 10.989
 - 2 33.417
 - 3 163.5
 - 4 293.609
- 589 The crew aboard a small fishing boat caught 350 pounds of fish on Monday. From that Monday through the end of the week on Friday, the weight of the fish caught increased 15% per day. The total weight, in pounds, of fish caught is approximately
- 1 411
 - 2 612
 - 3 1748
 - 4 2360
- 590 A 7-year lease for office space states that the annual rent is \$85,000 for the first year and will increase by 6% each additional year of the lease. What will the total rent expense be for the entire 7-year lease?
- 1 \$42,809.63
 - 2 \$90,425.53
 - 3 \$595,000.00
 - 4 \$713,476.20
- 591 A research assistant receives a first year salary of \$90,000 and a 2% annual raise throughout the first ten years of employment. In total, how much money will be earned over the first ten years, to the *nearest dollar*?
- 1 \$91,837
 - 2 \$109,709
 - 3 \$877,917
 - 4 \$985,475
- 592 Brian deposited 1 cent into an empty non-interest bearing bank account on the first day of the month. He then additionally deposited 3 cents on the second day, 9 cents on the third day, and 27 cents on the fourth day. What would be the total amount of money in the account at the end of the 20th day if the pattern continued?
- 1 \$11,622,614.67
 - 2 \$17,433,922.00
 - 3 \$116,226,146.80
 - 4 \$1,743,392,200.00
- 593 Given the geometric series $300 + 360 + 432 + 518.4 + \dots$, write a geometric series formula, S_n , for the sum of the first n terms. Use the formula to find the sum of the first 10 terms, to the *nearest tenth*.
- 594 The initial push of a child on a swing causes the swing to travel a total of 6 feet. Each successive swing travels 80% of the distance of the previous swing. Determine the total distance, to the *nearest hundredth of a foot*, a child travels in the first five swings.
- 595 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

596 Sonja is cutting wire to construct a mobile. She cuts 100 inches for the first piece, 80 inches for the second piece, and 64 inches for the third piece. Assuming this pattern continues, write an explicit equation for a_n , the length in inches of the n th piece. Sonja only has 40 feet of wire to use for the project and wants to cut 20 pieces total for the mobile using her pattern. Will she have enough wire? Justify your answer.

597 Use the geometric series formula to determine the total 30-year earnings for an employee whose first-year salary is \$42,000 and earns an annual raise of 3%, rounded to the *nearest thousand dollars*.

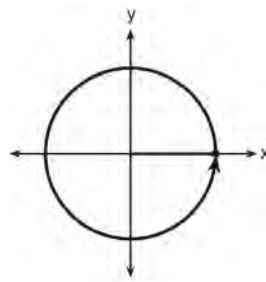
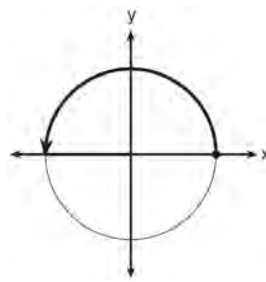
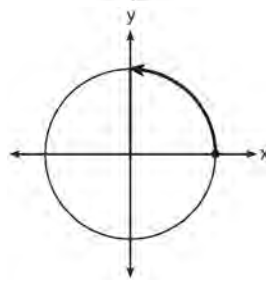
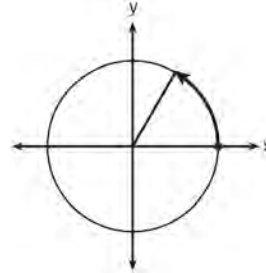
598 Alexa earns \$33,000 in her first year of teaching and earns a 4% increase in each successive year. Write a geometric series formula, S_n , for Alexa's total earnings over n years. Use this formula to find Alexa's total earnings for her first 15 years of teaching, to the *nearest cent*.

599 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise. Write a geometric series formula, C_n , for Christopher's total earnings over n years. Use this formula to find Christopher's total earnings, to the nearest hundred dollars, over his first 10 years of employment.

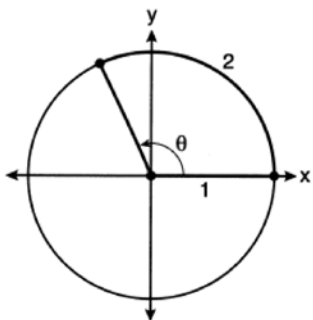
TRIGONOMETRY

F.TF.A.1: UNIT CIRCLE

600 Which diagram shows an angle rotation of 1 radian on the unit circle?



- 601 An angle, θ , is rotated counterclockwise on the unit circle, with its terminal side in the second quadrant, as shown in the diagram below.

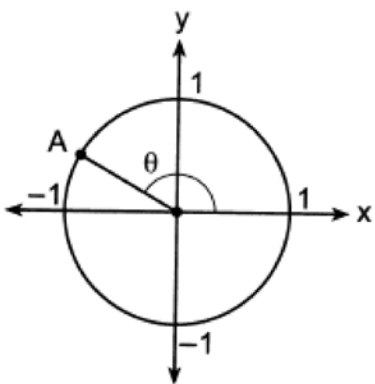


Which value represents the radian measure of angle θ ?

- 1 1
- 2 2
- 3 65.4
- 4 114.6

F.TF.A.2: UNIT CIRCLE

- 602 In the diagram of a unit circle below, point A, $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$, represents the point where the terminal side of θ intersects the unit circle.



What is $m\angle\theta$?

- 1 30°
- 2 120°
- 3 135°
- 4 150°

- 603 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t .

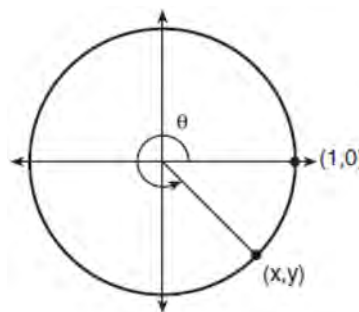
F.TF.A.2: RECIPROCAL TRIGONOMETRIC RELATIONSHIPS

- 604 The terminal side of θ , an angle in standard position, intersects the unit circle at $P\left(-\frac{1}{3}, -\frac{\sqrt{8}}{3}\right)$.

What is the value of $\sec \theta$?

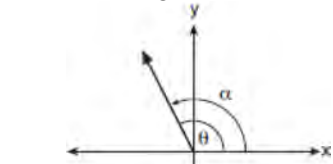
- 1 -3
- 2 $-\frac{3\sqrt{8}}{8}$
- 3 $-\frac{1}{3}$
- 4 $-\frac{\sqrt{8}}{3}$

- 605 Using the unit circle below, explain why $\csc \theta = \frac{1}{y}$.

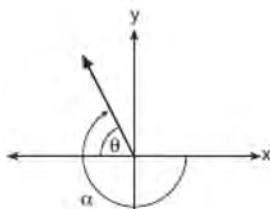


F.TF.A.2: REFERENCE ANGLES

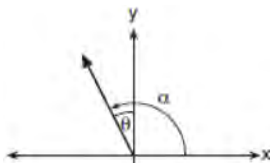
- 606 Which diagram represents an angle, α , measuring $\frac{13\pi}{20}$ radians drawn in standard position, and its reference angle, θ ?



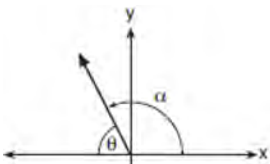
1



2



3



4

F.TF.A.2: DETERMINING TRIGONOMETRIC FUNCTIONS

- 607 If the terminal side of angle θ , in standard position, passes through point $(-4,3)$, what is the numerical value of $\sin \theta$?

1 $\frac{3}{5}$

2 $\frac{4}{5}$

3 $-\frac{3}{5}$

4 $-\frac{4}{5}$

- 608 A circle centered at the origin has a radius of 10 units. The terminal side of an angle, θ , intercepts the circle in Quadrant II at point C. The y-coordinate of point C is 8. What is the value of $\cos \theta$?

1 $-\frac{3}{5}$

2 $-\frac{3}{4}$

3 $\frac{3}{5}$

4 $\frac{4}{5}$

- 609 If θ is an angle in standard position whose terminal side passes through the point $(-2,-3)$, what is the numerical value of $\tan \theta$?

1 $\frac{2}{3}$

2 $\frac{3}{2}$

3 $-\frac{2}{\sqrt{13}}$

4 $-\frac{3}{\sqrt{13}}$

610 The exact value of $\sin\left(\frac{8\pi}{3}\right)$ is

- 1 $\frac{1}{2}$
- 2 $-\frac{1}{2}$
- 3 $-\frac{\sqrt{3}}{2}$
- 4 $\frac{\sqrt{3}}{2}$

611 What is the exact value of $\tan\left(-\frac{5\pi}{6}\right)$?

- 1 $\frac{1}{\sqrt{3}}$
- 2 $-\frac{1}{\sqrt{3}}$
- 3 $\sqrt{3}$
- 4 $-\sqrt{3}$

612 If θ is an angle in standard position whose terminal side passes through the point $(-3, -4)$, which statement is true?

- 1 $\sec \theta > 0$ and $\tan \theta > 0$
- 2 $\sec \theta < 0$ and $\tan \theta < 0$
- 3 $\sec \theta > 0$ and $\tan \theta < 0$
- 4 $\sec \theta < 0$ and $\tan \theta > 0$

613 An angle, θ , is in standard position and its terminal side passes through the point $(2, -1)$. Find the *exact* value of $\sin \theta$.

F.TF.C.8: DETERMINING TRIGONOMETRIC FUNCTIONS

614 Given $\cos \theta = \frac{7}{25}$, where θ is an angle in standard position terminating in quadrant IV, and $\sin^2 \theta + \cos^2 \theta = 1$, what is the value of $\tan \theta$?

- 1 $-\frac{24}{25}$
- 2 $-\frac{24}{7}$
- 3 $\frac{24}{25}$
- 4 $\frac{24}{7}$

615 Given $\sin \theta = \frac{7}{25}$ and θ terminates in quadrant II, what is the value of $\tan \theta$?

- 1 $-\frac{7}{24}$
- 2 $-\frac{24}{7}$
- 3 $\frac{7}{24}$
- 4 $\frac{24}{7}$

616 If $\cos \theta = -\frac{3}{4}$ and θ is in Quadrant III, then $\sin \theta$ is equivalent to

- 1 $-\frac{\sqrt{7}}{4}$
- 2 $\frac{\sqrt{7}}{4}$
- 3 $-\frac{5}{4}$
- 4 $\frac{5}{4}$

- 617 Given that $\sin^2 \theta + \cos^2 \theta = 1$ and $\sin \theta = -\frac{\sqrt{2}}{5}$, what is a possible value of $\cos \theta$?
- 1 $\frac{5 + \sqrt{2}}{5}$
 - 2 $\frac{\sqrt{23}}{5}$
 - 3 $\frac{3\sqrt{3}}{5}$
 - 4 $\frac{\sqrt{35}}{5}$
- 618 If $\cos A = \frac{\sqrt{5}}{3}$ and $\tan A < 0$, what is the value of $\sin A$?
- 1 $\frac{2}{3}$
 - 2 $-\frac{\sqrt{5}}{3}$
 - 3 $-\frac{2}{3}$
 - 4 $\frac{3}{\sqrt{5}}$
- 619 What is the value of $\tan \theta$ when $\sin \theta = \frac{2}{5}$ and θ is in quadrant II?
- 1 $\frac{-\sqrt{21}}{5}$
 - 2 $\frac{-\sqrt{21}}{2}$
 - 3 $\frac{-2}{\sqrt{21}}$
 - 4 $\frac{2}{\sqrt{21}}$
- 620 Given $\tan \theta = -\frac{4}{3}$ where $\frac{\pi}{2} < \theta < \pi$, what is the value of $\sec \theta$?
- 1 $-\frac{5}{3}$
 - 2 $-\frac{3}{5}$
 - 3 $\frac{4}{5}$
 - 4 $\frac{5}{3}$
- 621 Using the identity $\sin^2 \theta + \cos^2 \theta = 1$, find the value of $\tan \theta$, to the *nearest hundredth*, if $\cos \theta$ is -0.7 and θ is in Quadrant II.
- 622 Given $\cos \theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin \theta$.
- 623 An angle, θ , is drawn in standard position and terminates in Quadrant III. Given $\cos \theta = -\frac{\sqrt{10}}{10}$, determine the value of $\tan \theta$.
- 624 Given $\tan \theta = \frac{7}{24}$, and θ terminates in Quadrant III, determine the value of $\cos \theta$.
- 625 Given $\cos A = \frac{3}{\sqrt{10}}$ and $\cot A = -3$, determine the value of $\sin A$ in radical form.

F.TF.C.8: FINDING THE TERMINAL SIDE OF AN ANGLE

- 626 Natalia's teacher has given her the following information about angle θ .

- $\pi < \theta < 2\pi$

- $\cos \theta = \frac{\sqrt{3}}{4}$

Explain how Natalia can determine if the value of $\tan \theta$ is positive or negative.

F.TF.C.8: PROVING TRIGONOMETRIC IDENTITIES

- 627 If $\sin^2(32^\circ) + \cos^2(M) = 1$, then M equals
- 1 32°
 - 2 58°
 - 3 68°
 - 4 72°

F.TF.B.5: MODELING TRIGONOMETRIC FUNCTIONS

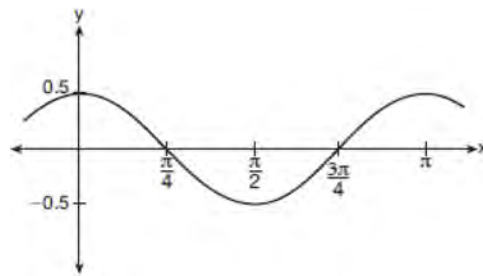
- 628 Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?

- 1 $y = -4 \cos\left(\frac{\pi}{4}x\right) - 3$
- 2 $y = -4 \cos\left(\frac{\pi}{4}x\right) + 5$
- 3 $y = -4 \cos(8x) - 3$
- 4 $y = -4 \cos(8x) + 5$

- 629 The voltage used by most households can be modeled by a sine function. The maximum voltage is 120 volts, and there are 60 cycles *every second*. Which equation best represents the value of the voltage as it flows through the electric wires, where t is time in seconds?

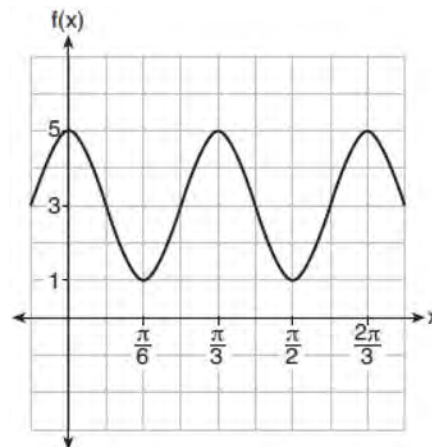
- 1 $V = 120 \sin(t)$
- 2 $V = 120 \sin(60t)$
- 3 $V = 120 \sin(60\pi t)$
- 4 $V = 120 \sin(120\pi t)$

- 630 Which equation is represented by the graph shown below?



- 1 $y = \frac{1}{2} \cos 2x$
- 2 $y = \cos x$
- 3 $y = \frac{1}{2} \cos x$
- 4 $y = 2 \cos \frac{1}{2}x$

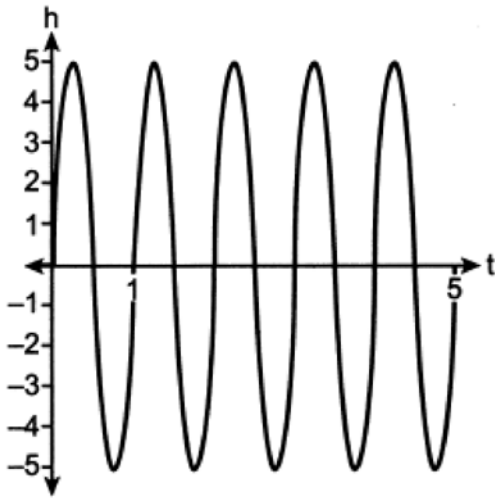
- 631 The function $f(x) = a \cos bx + c$ is plotted on the graph shown below.



What are the values of a , b , and c ?

- 1 $a = 2, b = 6, c = 3$
- 2 $a = 2, b = 3, c = 1$
- 3 $a = 4, b = 6, c = 5$
- 4 $a = 4, b = \frac{\pi}{3}, c = 3$

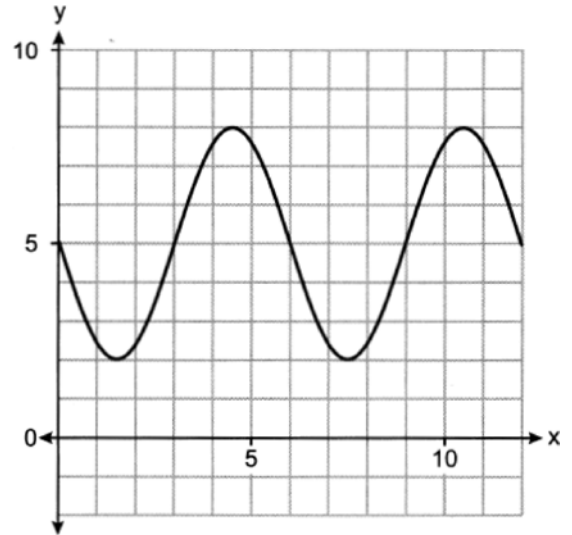
- 632 A cyclist pedals a bike at a rate of 60 revolutions per minute. The height, h , of a pedal at time t , in seconds, is plotted below.



The graph can be modeled by the function $h(t) = 5 \sin(kt)$, where k is equal to

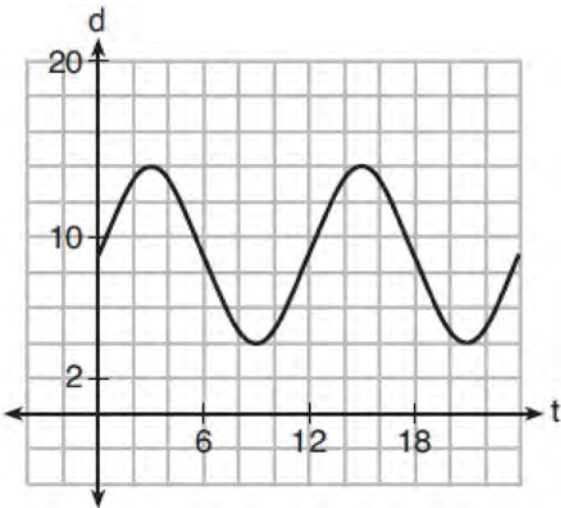
- 1 1
- 2 2π
- 3 60
- 4 $\frac{\pi}{30}$

- 633 Which equation is graphed in the diagram below?



- 1 $y = -3 \sin\left(\frac{\pi}{3}x\right) + 5$
- 2 $y = -3 \cos\left(\frac{\pi}{3}x\right) + 5$
- 3 $y = -5 \sin\left(\frac{\pi}{3}x\right) + 3$
- 4 $y = -5 \cos\left(\frac{\pi}{3}x\right) + 3$

- 634 The depth of the water at a marker 20 feet from the shore in a bay is depicted in the graph below.



If the depth, d , is measured in feet and time, t , is measured in hours since midnight, what is an equation for the depth of the water at the marker?

- 1 $d = 5 \cos\left(\frac{\pi}{6} t\right) + 9$
- 2 $d = 9 \cos\left(\frac{\pi}{6} t\right) + 5$
- 3 $d = 9 \sin\left(\frac{\pi}{6} t\right) + 5$
- 4 $d = 5 \sin\left(\frac{\pi}{6} t\right) + 9$

F.IF.B.4: GRAPHING TRIGONOMETRIC FUNCTIONS

- 635 Relative to the graph of $y = 3 \sin x$, what is the shift of the graph of $y = 3 \sin\left(x + \frac{\pi}{3}\right)$?
- 1 $\frac{\pi}{3}$ right
 - 2 $\frac{\pi}{3}$ left
 - 3 $\frac{\pi}{3}$ up
 - 4 $\frac{\pi}{3}$ down

- 636 Given the parent function $p(x) = \cos x$, which phrase best describes the transformation used to obtain the graph of $g(x) = \cos(x + a) - b$, if a and b are positive constants?
- 1 right a units, up b units
 - 2 right a units, down b units
 - 3 left a units, up b units
 - 4 left a units, down b units

- 637 The temperature, in degrees Fahrenheit, in Times Square during a day in August can be predicted by the function $T(x) = 8 \sin(0.3x - 3) + 74$, where x is the number of hours after midnight. According to this model, the predicted temperature, to the nearest degree Fahrenheit, at 7 P.M. is
- 1 68
 - 2 74
 - 3 77
 - 4 81

- 638 The hours of daylight, y , in Utica in days, x , from January 1, 2013 can be modeled by the equation $y = 3.06 \sin(0.017x - 1.40) + 12.23$. How many hours of daylight, to the nearest tenth, does this model predict for February 14, 2013?
- 1 9.4
 - 2 10.4
 - 3 12.1
 - 4 12.2

- 639 The Ferris wheel at the landmark Navy Pier in Chicago takes 7 minutes to make one full rotation. The height, H , in feet, above the ground of one of the six-person cars can be modeled by

$$H(t) = 70 \sin\left(\frac{2\pi}{7}(t - 1.75)\right) + 80, \text{ where } t \text{ is time,}$$

- in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is
- 1 150
 - 2 70
 - 3 10
 - 4 0

- 640 The average monthly temperature, $T(m)$, in degrees Fahrenheit, over a 12 month period, can be modeled by $T(m) = -23 \cos\left(\frac{\pi}{6} m\right) + 56$, where m is in months. What is the range of temperatures, in degrees Fahrenheit, of this function?
- 1 $[-23, 23]$
 - 2 $[33, 79]$
 - 3 $[-23, 56]$
 - 4 $[-79, 33]$
- 641 As θ increases from $-\frac{\pi}{2}$ to 0 radians, the value of $\cos \theta$ will
- 1 decrease from 1 to 0
 - 2 decrease from 0 to -1
 - 3 increase from -1 to 0
 - 4 increase from 0 to 1
- 642 A sine function increasing through the origin can be used to model light waves. Violet light has a wavelength of 400 nanometers. Over which interval is the height of the wave *decreasing*, only?
- 1 $(0, 200)$
 - 2 $(100, 300)$
 - 3 $(200, 400)$
 - 4 $(300, 400)$
- 643 Given $p(\theta) = 3 \sin\left(\frac{1}{2} \theta\right)$ on the interval $-\pi < \theta < \pi$, the function p
- 1 decreases, then increases
 - 2 increases, then decreases
 - 3 decreases throughout the interval
 - 4 increases throughout the interval
- 644 As x increases from 0 to $\frac{\pi}{2}$, the graph of the equation $y = 2 \tan x$ will
- 1 increase from 0 to 2
 - 2 decrease from 0 to -2
 - 3 increase without limit
 - 4 decrease without limit
- 645 The depth of the water, $d(t)$, in feet, on a given day at Thunder Bay, t hours after midnight is modeled by $d(t) = 5 \sin\left(\frac{\pi}{6}(t-5)\right) + 7$. Which statement about the Thunder Bay tide is *false*?
- 1 A low tide occurred at 2 a.m.
 - 2 The maximum depth of the water was 12 feet.
 - 3 The water depth at 9 a.m. was approximately 11 feet.
 - 4 The difference in water depth between high tide and low tide is 14 feet.
- 646 Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees F, can be modeled by the equation $B(x) = 23.914 \sin(0.508x - 2.116) + 55.300$. The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found the temperatures could be modeled by the equation $P(x) = 20.238 \sin(0.525x - 2.148) + 86.729$. Which statement can *not* be concluded based on the average monthly temperature models x months after starting data collection?
- 1 The average monthly temperature variation is more in Bar Harbor than in Phoenix.
 - 2 The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
 - 3 The maximum average monthly temperature for Bar Harbor is 79° F, to the nearest degree.
 - 4 The minimum average monthly temperature for Phoenix is 20° F, to the nearest degree.
- 647 The function $d(t) = 2 \cos\left(\frac{\pi}{6} t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

648 A person's lung capacity can be modeled by the function $C(t) = 250 \sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

649 The height, $h(t)$ in cm, of a piston, is given by the equation $h(t) = 12 \cos\left(\frac{\pi}{3}t\right) + 8$, where t represents the number of seconds since the measurements began. Determine the average rate of change, in cm/sec, of the piston's height on the interval $1 \leq t \leq 2$. At what value(s) of t , to the nearest tenth of a second, does $h(t) = 0$ in the interval $1 \leq t \leq 5$? Justify your answer.

F.IF.C.7: GRAPHING TRIGONOMETRIC FUNCTIONS

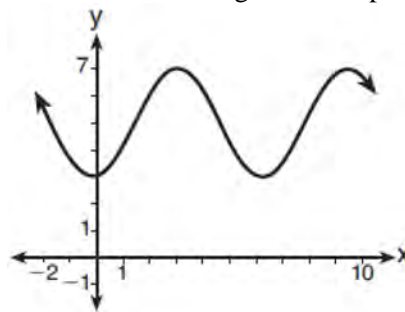
650 The equation below can be used to model the height of a tide in feet, $H(t)$, on a beach at t hours.

$$H(t) = 4.8 \sin\left(\frac{\pi}{6}(t+3)\right) + 5.1$$

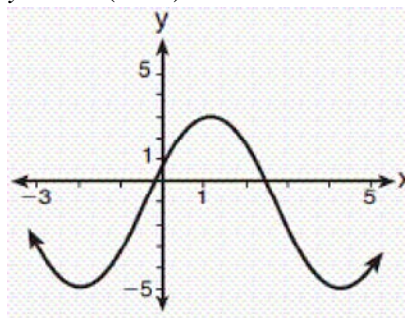
Using this function, the amplitude of the tide is

- 1 $\frac{\pi}{6}$
- 2 4.8
- 3 3
- 4 5.1

651 Which sinusoid has the greatest amplitude?



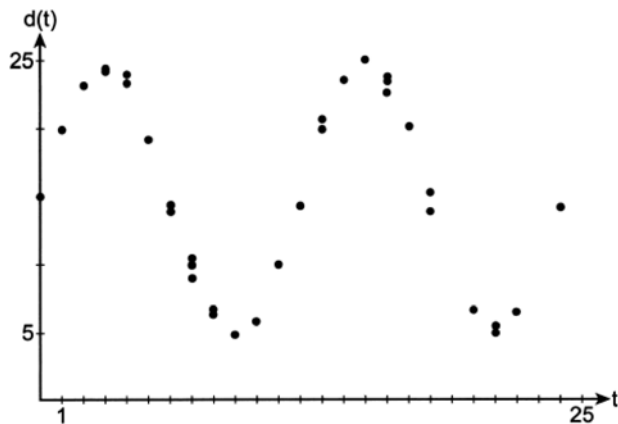
- 1
- 2 $y = 3 \sin(\theta - 3) + 5$



- 3
- 4 $y = -5 \sin(\theta - 1) - 3$

652 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of -2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of -0.1 ft at 5:31 a.m. The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

- 653 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



The depth of the water can be modeled with a trigonometric function of the form

$d(t) = A \sin\left(\frac{\pi}{6} t\right) + C$. Estimate the value of A , to the nearest integer. Justify your answer.

- 654 Given the equation $S(x) = 1.7 \sin(bx) + 12$, where the period of $S(x)$ is 12, what is the value of b ?
- 1 $\frac{\pi}{6}$
 - 2 24π
 - 3 $\frac{\pi}{12}$
 - 4 6π

- 655 The height above ground for a person riding a Ferris wheel after t seconds is modeled by
- $$h(t) = 150 \sin\left(\frac{\pi}{45} t + 67.5\right) + 160 \text{ feet.}$$

How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

- 1 10
 - 2 45
 - 3 90
 - 4 150
- 656 The graph of which function has a period of 3?

- 1 $y = -7 \sin\left(\frac{2\pi}{3} x\right) - 5$
- 2 $y = -7 \sin\left(\frac{3\pi}{2} x\right) + 9$
- 3 $y = -7 \sin(3x) - 5$
- 4 $y = 3 \sin(\pi x) + 9$

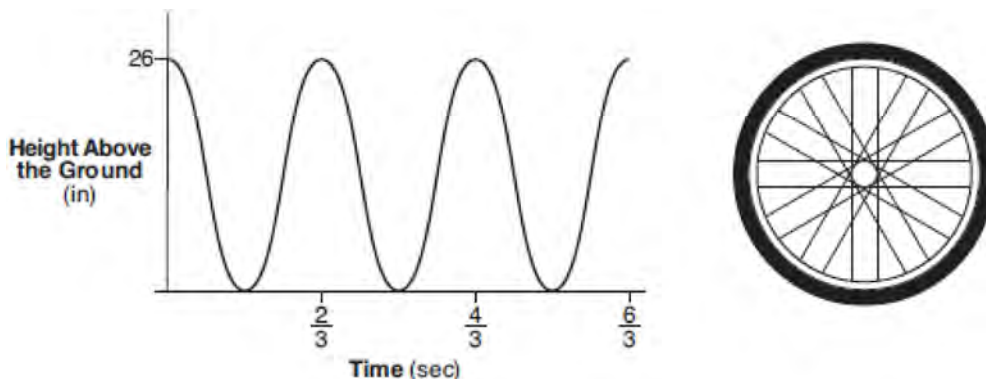
- 657 The height, above ground, of a Ferris wheel car can be modeled by the function

$$h(t) = -103.5 \cos\left(\frac{2\pi t}{5}\right) + 108.5$$

where h is measured in feet and t is measured in minutes.

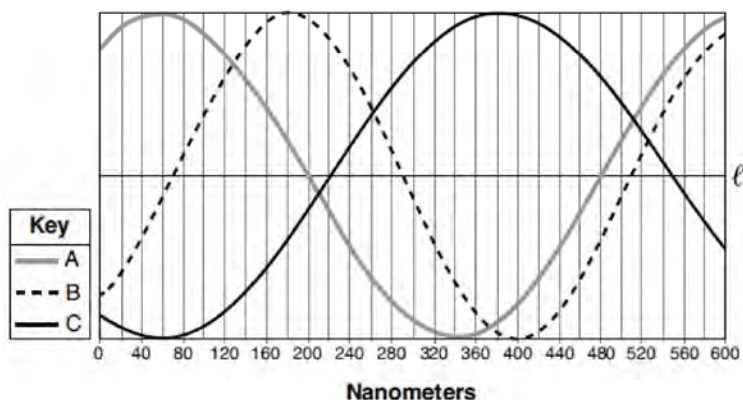
State the period of the function and describe what the period represents in this context.

- 658 The graph below represents the height above the ground, h , in inches, of a point on a triathlete's bike wheel during a training ride in terms of time, t , in seconds.



Identify the period of the graph and describe what the period represents in this context.

- 659 Visible light can be represented by sinusoidal waves. Three visible light waves are shown in the graph below. The midline of each wave is labeled ℓ .



Based on the graph, which light wave has the longest period? Justify your answer.

- 660 Which statement is *incorrect* for the graph of the function $y = -3 \cos \left[\frac{\pi}{3} (x - 4) \right] + 7$?

- 1 The period is 6.
- 2 The amplitude is 3.
- 3 The range is $[4, 10]$.
- 4 The midline is $y = -4$.

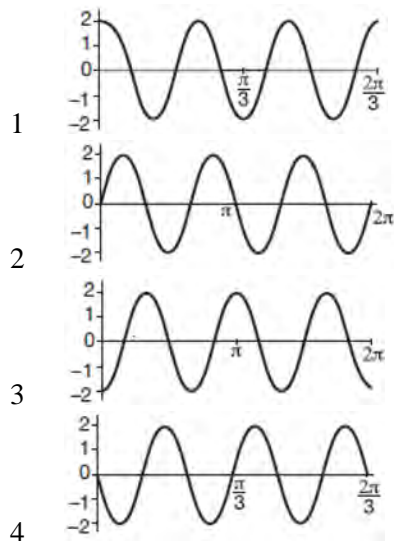
- 661 Tides are a periodic rise and fall of ocean water. On a typical day at a seaport, to predict the time of the next high tide, the most important value to have would be the

- 1 time between consecutive low tides
- 2 time when the tide height is 20 feet
- 3 average depth of water over a 24-hour period
- 4 difference between the water heights at low and high tide

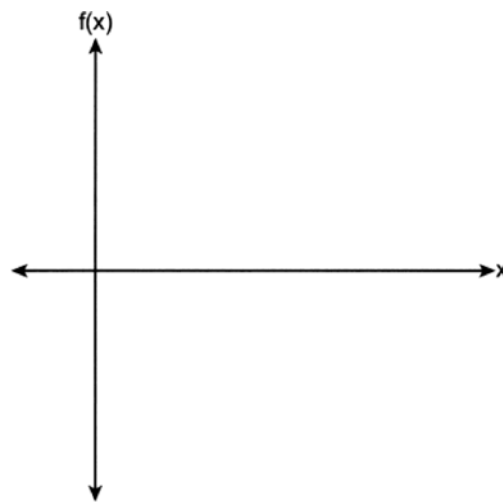
- 662 The average monthly temperature of a city can be modeled by a cosine graph. Melissa has been living in Phoenix, Arizona, where the average annual temperature is 75°F . She would like to move, and live in a location where the average annual temperature is 62°F . When examining the graphs of the average monthly temperatures for various locations, Melissa should focus on the
- 1 amplitude
 - 2 horizontal shift
 - 3 period
 - 4 midline

- 663 The volume of air in a person's lungs, as the person breathes in and out, can be modeled by a sine graph. A scientist is studying the differences in this volume for people at rest compared to people told to take a deep breath. When examining the graphs, should the scientist focus on the amplitude, period, or midline? Explain your choice.

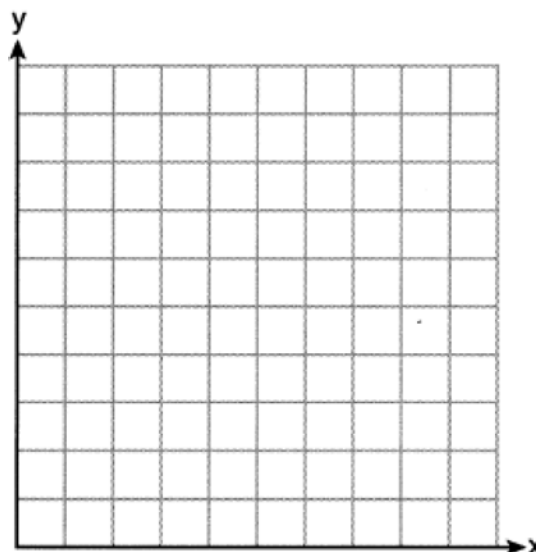
- 664 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?



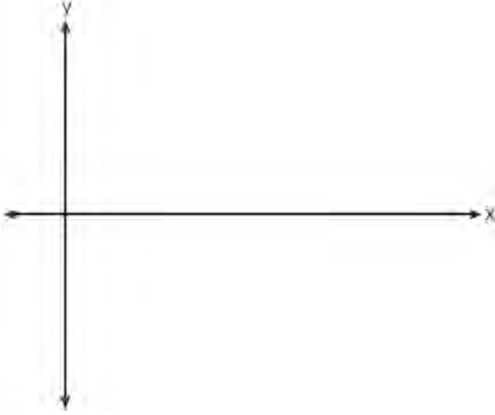
- 665 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.



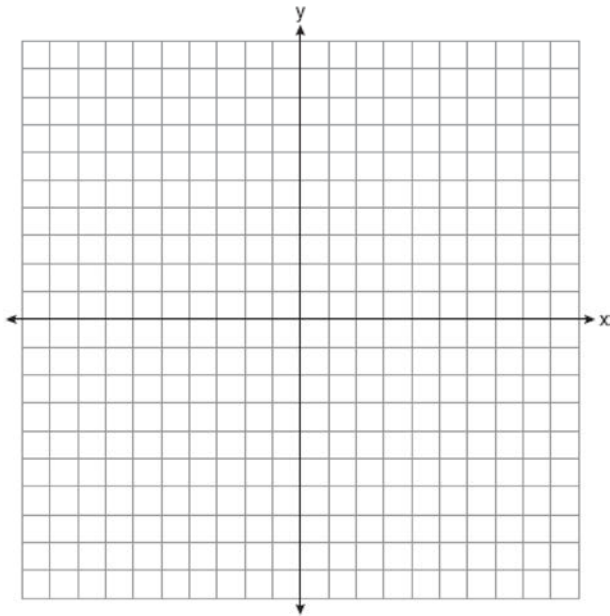
- 666 Graph $y = 2\cos\left(\frac{1}{2}x\right) + 5$ on the interval $[0, 2\pi]$, using the axes below.



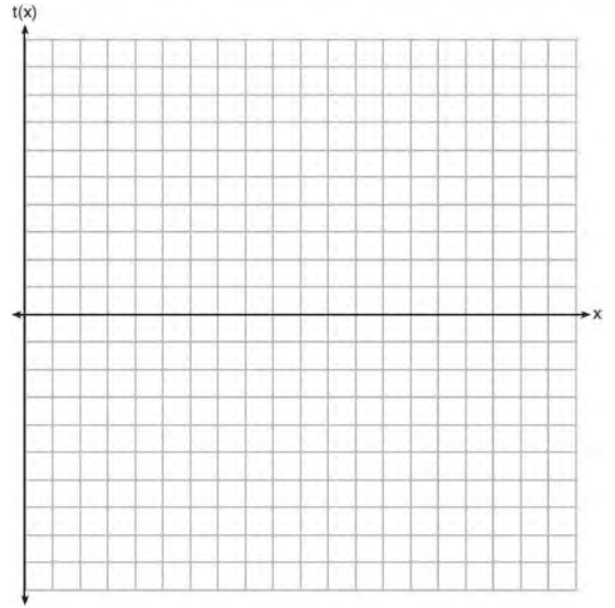
- 667 On the coordinate plane below, sketch *at least one cycle* of a cosine function with a midline at $y = -2$, an amplitude of 3, and a period of $\frac{\pi}{2}$.



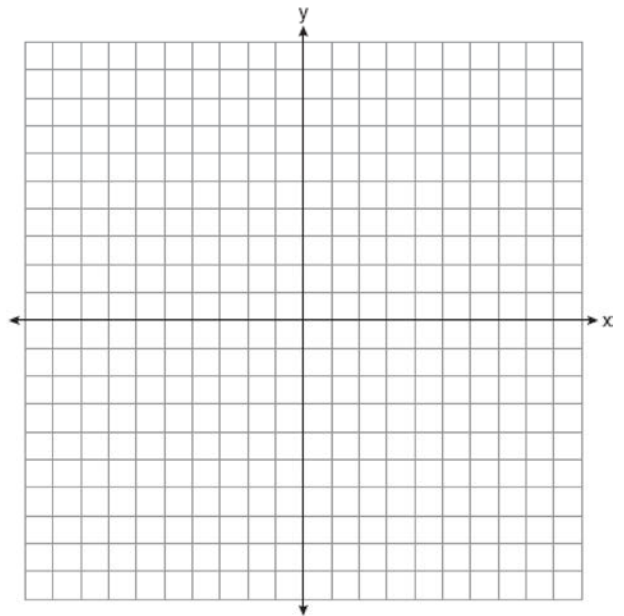
- 668 On the axes below, graph *one cycle* of a cosine function with amplitude 3, period $\frac{\pi}{2}$, midline $y = -1$, and passing through the point $(0, 2)$.



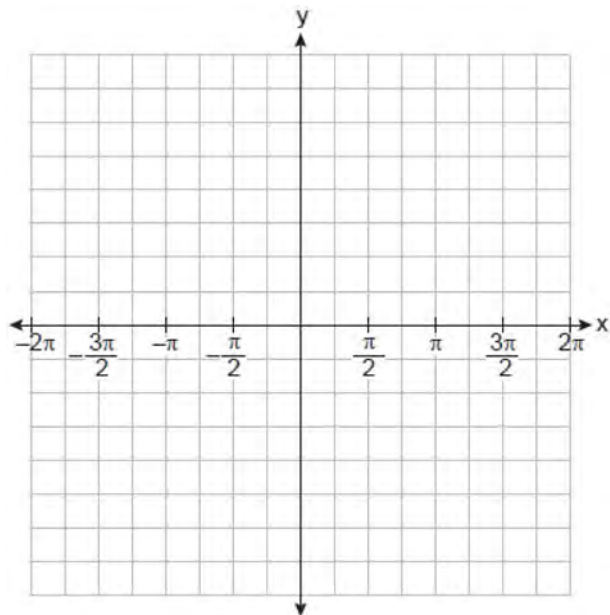
- 669 Graph $t(x) = 3 \sin(2x) + 2$ over the domain $[0, 2\pi]$ on the set of axes below.



- 670 Graph *at least one cycle* of $y = 5 \sin(4x) - 3$ on the set of axes below.

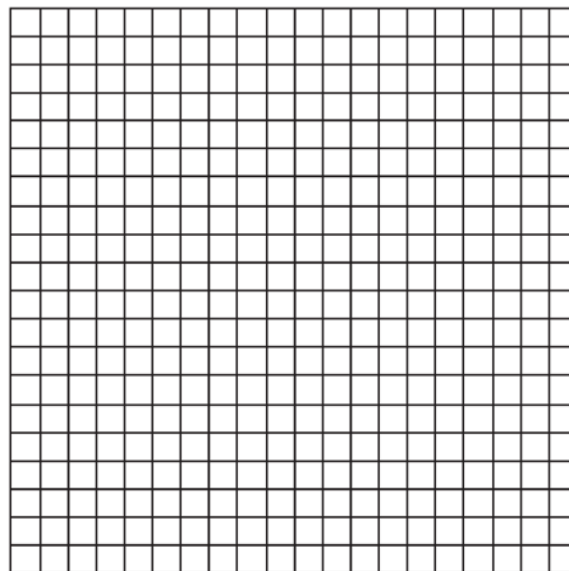


- 671 On the graph below, draw at least one complete cycle of a sine graph passing through point $(0,2)$ that has an amplitude of 3, a period of π , and a midline at $y = 2$.

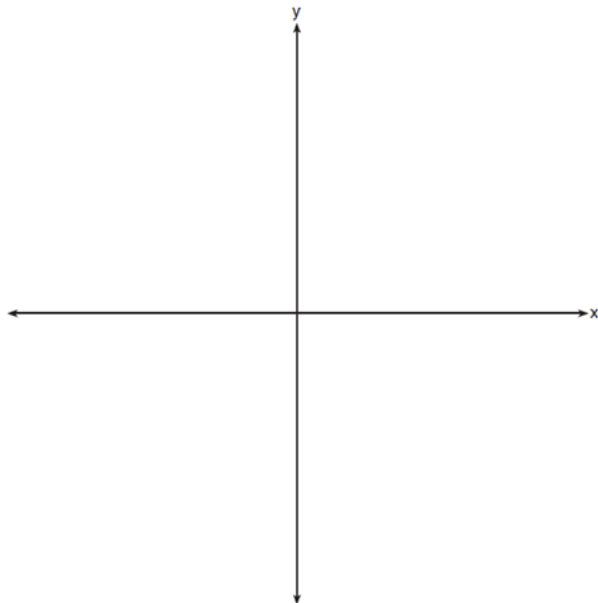


Based on your graph, state an interval in which the graph is increasing.

- 672 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$. On the grid below, sketch the graph of the equation in the interval 0 to 2π .

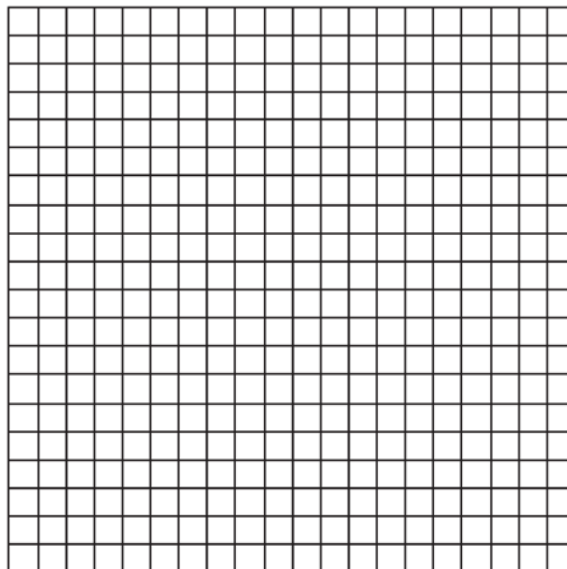


- 673 a) On the axes below, sketch *at least one* cycle of a sine curve with an amplitude of 2, a midline at $y = -\frac{3}{2}$, and a period of 2π .



- b) Explain any differences between a sketch of $y = 2 \sin\left(x - \frac{\pi}{3}\right) - \frac{3}{2}$ and the sketch from part a.

- 674 Griffin is riding his bike down the street in Churchville, N.Y. at a constant speed, when a nail gets caught in one of his tires. The height of the nail above the ground, in inches, can be represented by the trigonometric function $f(t) = -13 \cos(0.8\pi t) + 13$, where t represents the time (in seconds) since the nail first became caught in the tire. Determine the period of $f(t)$. Interpret what the period represents in this context. On the grid below, graph *at least one* cycle of $f(t)$ that includes the y-intercept of the function.

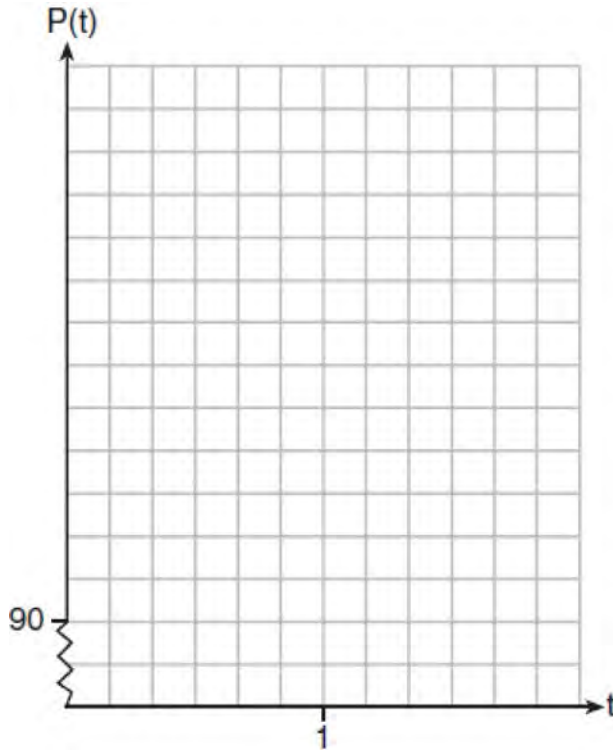


Does the height of the nail ever reach 30 inches above the ground? Justify your answer.

- 675 The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

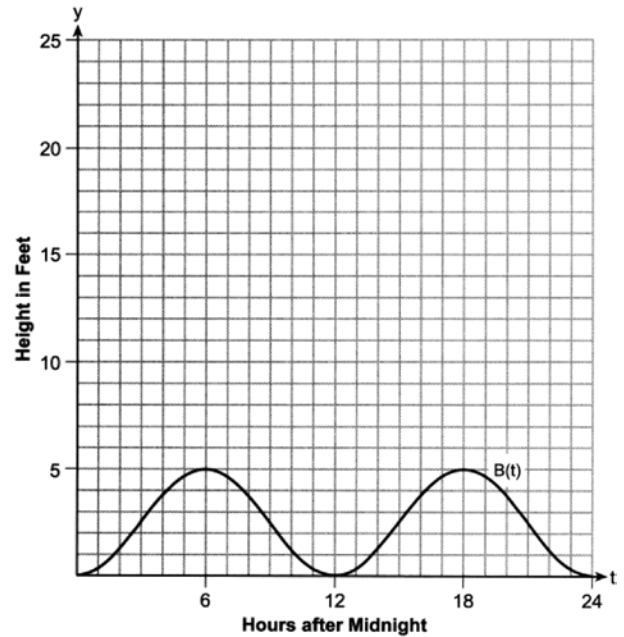
$$P(t) = 24 \cos(3\pi t) + 120$$

On the set of axes below, graph $y = P(t)$ over the domain $0 \leq t \leq 2$.



Determine the period of P . Explain what this value represents in the given context. Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with low blood pressure (below 90 over 60) may be at risk for health disorders. Classify the given patient's blood pressure as low, normal, or high and explain your reasoning.

- 676 The height, in feet, of the tides along the coastlines can be measured with water levels oscillating between low tide and high tide. The graph below shows the height of the tides, $y = B(t)$, in feet, in Daytona Beach, t hours after midnight on a day in July.



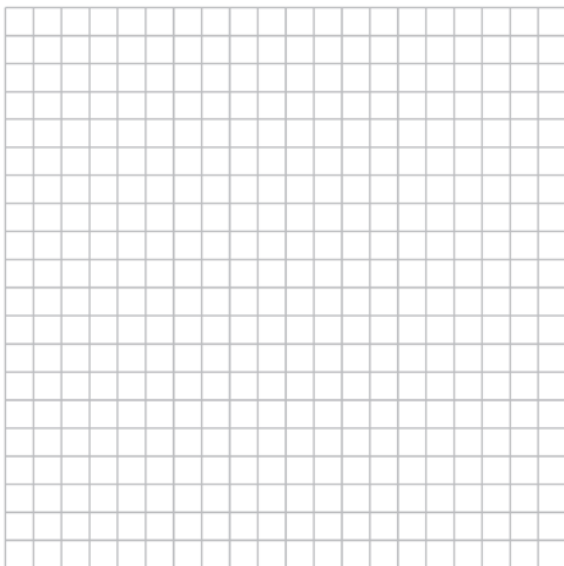
State the period of $B(t)$, in hours. Write an equation for $B(t)$ in the form $B(t) = a \cos(bt) + c$. In Derby, Australia, the height of the tide, in feet, can be modeled by the function

$$D(t) = 8 \cos\left(\frac{\pi}{6} t\right) + 16.5.$$

On the grid above, graph $y = D(t)$ on the domain $0 \leq t \leq 24$. State the height, in feet, of the low tide in Derby.

Algebra II Regents Exam Questions by State Standard: Topic

677 The ocean tides near Carter Beach follow a repeating pattern over time, with the amount of time between each low and high tide remaining relatively constant. On a certain day, low tide occurred at 8:30 a.m. and high tide occurred at 3:00 p.m. At high tide, the water level was 12 inches above the average local sea level; at low tide it was 12 inches below the average local sea level. Assume that high tide and low tide are the maximum and minimum water levels each day, respectively. Write a cosine function of the form $f(t) = A \cos(Bt)$, where A and B are real numbers, that models the water level, $f(t)$, in inches above or below the average Carter Beach sea level, as a function of the time measured in t hours since 8:30 a.m. On the grid below, graph one cycle of this function.



People who fish in Carter Beach know that a certain species of fish is most plentiful when the water level is increasing. Explain whether you would recommend fishing for this species at 7:30 p.m. or 10:30 p.m. using evidence from the given context.

CONICS

G.GPE.A.1: EQUATIONS OF CIRCLES

- 678 The equation $4x^2 - 24x + 4y^2 + 72y = 76$ is equivalent to
- 1 $4(x - 3)^2 + 4(y + 9)^2 = 76$
 - 2 $4(x - 3)^2 + 4(y + 9)^2 = 121$
 - 3 $4(x - 3)^2 + 4(y + 9)^2 = 166$
 - 4 $4(x - 3)^2 + 4(y + 9)^2 = 436$

PROBABILITY

S.CP.B.7: ADDITION RULE

- 679 The probabilities that a randomly selected teenager uses social media websites F and I are shown below.

$$P(F) = 0.71$$

$$P(I) = 0.52$$

$$P(F \text{ or } I) = 0.77$$

Given this information, what is $P(F \text{ and } I)$, the probability that a randomly selected teenager uses both websites?

- 1 0.06
 - 2 0.19
 - 3 0.46
 - 4 0.96
- 680 In a survey of people who recently bought a laptop, 45% said they were looking for a large screen, 31% said they were looking for a fast processor, and 58% said they wanted a large screen or a fast processor. If a survey respondent is selected at random, what is the probability that the respondent wanted both a large screen and a fast processor?
- 1 76%
 - 2 14%
 - 3 77%
 - 4 18%

- 681 The probability of having math homework is $\frac{1}{3}$ and the probability of having English homework is $\frac{1}{7}$. The probability of having math homework or having English homework is $\frac{9}{21}$. What is the probability of having math homework and having English homework?
- $\frac{19}{21}$
 - $\frac{1}{5}$
 - $\frac{1}{21}$
 - $\frac{10}{21}$
- 682 In a group of 40 people, 20 have brown hair, 22 have blue eyes, and 15 have both brown hair and blue eyes. How many people have neither brown hair nor blue eyes?
- 0
 - 13
 - 27
 - 32
- 683 A suburban high school has a population of 1376 students. The number of students who participate in sports is 649. The number of students who participate in music is 433. If the probability that a student participates in either sports or music is $\frac{974}{1376}$, what is the probability that a student participates in both sports and music?
- 684 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.
- 685 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other. Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed. Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.
- 686 Given events A and B , such that $P(A) = 0.6$, $P(B) = 0.5$, and $P(A \cup B) = 0.8$, determine whether A and B are independent or dependent.
- 687 A student is chosen at random from the student body at a given high school. The probability that the student selects Math as the favorite subject is $\frac{1}{4}$. The probability that the student chosen is a junior is $\frac{116}{459}$. If the probability that the student selected is a junior or that the student chooses Math as the favorite subject is $\frac{47}{108}$, what is the exact probability that the student selected is a junior whose favorite subject is Math? Are the events "the student is a junior" and "the student's favorite subject is Math" independent of each other? Explain your answer.
- 688 In contract negotiations between a local government agency and its workers, it is estimated that there is a 50% chance that an agreement will be reached on the salaries of the workers. It is estimated that there is a 70% chance that there will be an agreement on the insurance benefits. There is a 20% chance that no agreement will be reached on either issue. Find the probability that an agreement will be reached on *both* issues. Based on this answer, determine whether the agreement on salaries and the agreement on insurance are independent events. Justify your answer.

S.CP.A.4: CONDITIONAL PROBABILITY

689 At a high school, 10th-grade students were recently asked if they walk to school and if they eat breakfast. The survey results are summarized in the table below.

	Walks to School	Doesn't Walk to School
Eats Breakfast	7	53
Doesn't Eat Breakfast	10	30

What is the probability that a randomly selected 10th-grade student from the school walks to school or eats breakfast?

- 1 0.07
- 2 0.70
- 3 0.77
- 4 0.84

690 Consider the data in the table below.

	Right Handed	Left Handed
Male	87	13
Female	89	11

What is the probability that a randomly selected person is male given the person is left handed?

- 1 $\frac{13}{200}$
- 2 $\frac{13}{100}$
- 3 $\frac{13}{50}$
- 4 $\frac{13}{24}$

691 The table below shows the food preferences of sports fans whose favorite sport is football or baseball.

Favorite Food to Eat While Watching Sports			
	Wings	Pizza	Hot Dogs
Football	14	20	6
Baseball	6	12	42

The probability that a fan prefers pizza given that the fan prefers football is

- 1 $\frac{1}{2}$
- 2 $\frac{1}{5}$
- 3 $\frac{5}{8}$
- 4 $\frac{13}{25}$

- 695 A survey about television-viewing preferences was given to randomly selected freshmen and seniors at Fairport High School. The results are shown in the table below.

Favorite Type of Program			
	Sports	Reality Show	Comedy Series
Senior	83	110	67
Freshmen	119	103	54

A student response is selected at random from the results. State the *exact* probability the student response is from a freshman, given the student prefers to watch reality shows on television.

- 696 Data collected about jogging from students with two older siblings are shown in the table below.

	Neither Sibling Jogs	One Sibling Jogs	Both Siblings Jog
Student Does Not Jog	1168	1823	1380
Student Jogs	188	416	400

Using these data, determine whether a student with two older siblings is more likely to jog if one sibling jogs or if both siblings jog. Justify your answer.

- 697 The number of employees who work nights and weekends at a department store is summarized in the table below.

	Works Nights	Doesn't Work Nights
Works Weekends	8	40
Doesn't Work Weekends	12	60

Let N represent the event "works nights" and let W represent the event "works weekends." Based on the table, are N and W independent events?

- 1 Yes, because $P(N) \cdot P(W) = P(N \cap W)$. 3 No, because $P(N) \cdot P(W) = P(N \cap W)$.
 2 Yes, because $P(N) \cdot P(W) \neq P(N \cap W)$. 4 No, because $P(N) \cdot P(W) \neq P(N \cap W)$.
- 698 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise
Female	87	94	21
Male	68	110	18

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

- 699 The results of a survey of the student body at Central High School about television viewing preferences are shown below.

	Comedy Series	Drama Series	Reality Series	Total
Males	95	65	70	230
Females	80	70	110	260
Total	175	135	180	490

Are the events “student is a male” and “student prefers reality series” independent of each other? Justify your answer.

- 700 Juan and Filipe practice at the driving range before playing golf. The number of wins and corresponding practice times for each player are shown in the table below.

	Juan Wins	Felipe Wins
Short Practice Time	8	10
Long Practice Time	15	12

Given that the practice time was long, determine the exact probability that Filipe wins the next match. Determine whether or not the two events “Filipe wins” and “long practice time” are independent. Justify your answer.

- 701 The relative frequency table shows the proportion of a population who have a given eye color and the proportion of the same population who wear glasses.

	Wear Glasses	Don't Wear Glasses
Blue Eyes	0.14	0.26
Brown Eyes	0.11	0.24
Green Eyes	0.10	0.15

Given the data, are the events of having blue eyes and wearing glasses independent? Justify your answer.

- 702 The transportation methods used by the upperclassmen at Calhoun High School are summarized in the table below.

Upperclassmen Transportation Methods			
	Drive	Take the Bus	Walk
Junior	58	75	12
Senior	81	39	12

Are the events "being a junior" and "driving to school" independent? Using statistical evidence, justify your answer.

Algebra II Regents Exam Questions by State Standard: Topic

www.jmap.org

- 703 The table below shows the results of gender and music preference. Based on these data, determine if the events "the person is female" and "the person prefers classic rock" are independent of each other. Justify your answer.

	Rap	Techno	Classic Rock	Classical
Male	39	17	42	12
Female	17	37	36	15

- 704 The results of a poll of 200 students are shown in the table below:

	Preferred Music Style		
	Techno	Rap	Country
Female	54	25	27
Male	36	40	18

For this group of students, do these data suggest that gender and preferred music styles are independent of each other? Justify your answer.

- 705 A public radio station held a fund-raiser. The table below summarizes the donor category and method of donation.

		Donor Category	
		Supporter	Patron
Method of Donation	Phone calls	400	672
	Online	1200	2016

To the *nearest thousandth*, find the probability that a randomly selected donor was categorized as a supporter, given that the donation was made online. Do these data indicate that being a supporter is independent of donating online? Justify your answer.

- 706 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

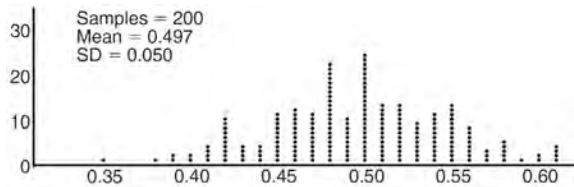
	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk. Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts. Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

GRAPHS AND STATISTICS

S.I.C.A.2: ANALYSIS OF DATA

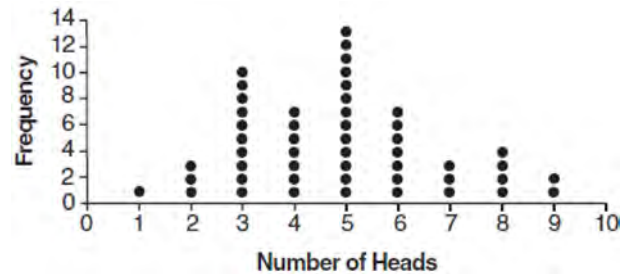
- 707 Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.



Given the results of her coin flips and of her computer simulation, which statement is most accurate?

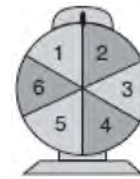
- 1 73 of the computer's next 100 coin flips will be heads.
- 2 50 of her next 100 coin flips will be heads.
- 3 Her coin is not fair.
- 4 Her coin is fair.

- 708 The results of simulating tossing a coin 10 times, recording the number of heads, and repeating this 50 times are shown in the graph below.

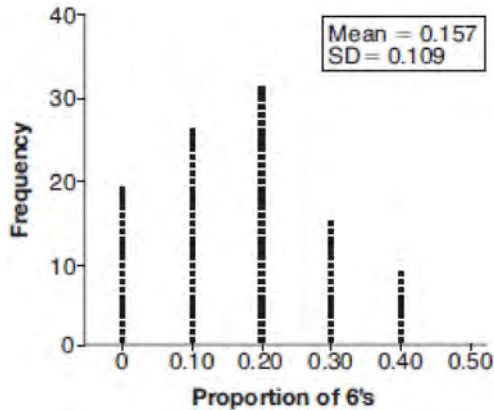


Based on the results of the simulation, which statement is *false*?

- 1 Five heads occurred most often, which is consistent with the theoretical probability of obtaining a heads.
 - 2 Eight heads is unusual, as it falls outside the middle 95% of the data.
 - 3 Obtaining three heads or fewer occurred 28% of the time.
 - 4 Seven heads is not unusual, as it falls within the middle 95% of the data.
- 709 A game spinner is divided into 6 equally sized regions, as shown in the diagram below.



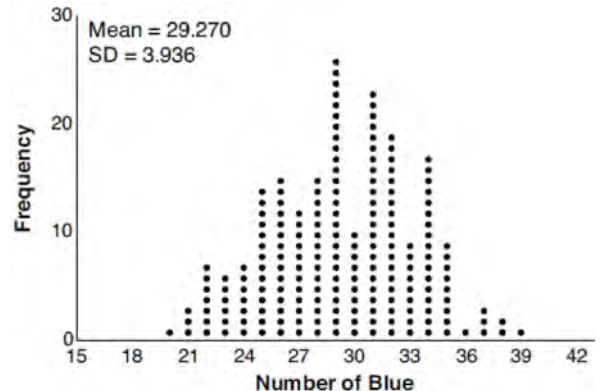
For Miles to win, the spinner must land on the number 6. After spinning the spinner 10 times, and losing all 10 times, Miles complained that the spinner is unfair. At home, his dad ran 100 simulations of spinning the spinner 10 times, assuming the probability of winning each spin is $\frac{1}{6}$. The output of the simulation is shown in the diagram below.



Which explanation is appropriate for Miles and his dad to make?

- 1 The spinner was likely unfair, since the number 6 failed to occur in about 20% of the simulations.
- 2 The spinner was likely unfair, since the spinner should have landed on the number 6 by the sixth spin.
- 3 The spinner was likely not unfair, since the number 6 failed to occur in about 20% of the simulations.
- 4 The spinner was likely not unfair, since in the output the player wins once or twice in the majority of the simulations.

- 710 The J& B candy company claims that 45% of the candies it produces are blue, 30% are brown, and 25% are yellow. Each bag holds 65 candies. A simulation was run 200 times, each of sample size 65, based on the premise that 45% of the candies are blue. The results of the simulation are shown below.

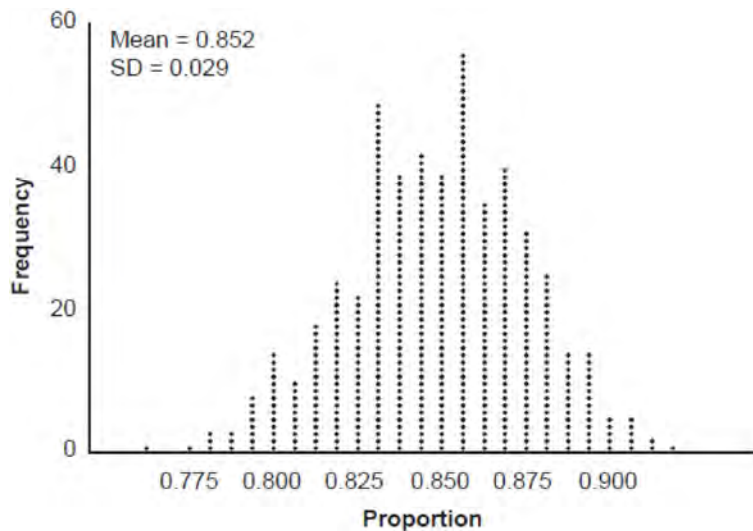


Bonnie purchased a bag of J& B's candy and counted 24 blue candies. What inference can be made regarding a bag of J& B's with only 24 blue candies?

- 1 The company is not meeting their production standard.
 - 2 Bonnie's bag was a rarity and the company should not be concerned.
 - 3 The company should change their claim to 37% blue candies are produced.
 - 4 Bonnie's bag is within the middle 95% of the simulated data supporting the company's claim.
- 711 Mrs. Jones had hundreds of jelly beans in a bag that contained equal numbers of six different flavors. Her student randomly selected four jelly beans and they were all black licorice. Her student complained and said "What are the odds I got all of that kind?" Mrs. Jones replied, "simulate rolling a die 250 times and tell me if four black licorice jelly beans is unusual." Explain how this simulation could be used to solve the problem.

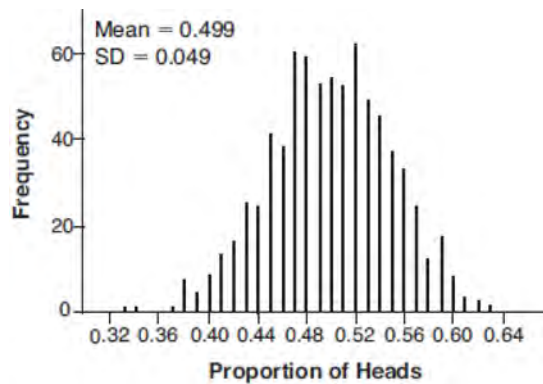
712 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045. Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

713 An app design company believes that the proportion of high school students who have purchased apps on their smartphones in the past 3 months is 0.85. A simulation of 500 samples of 150 students was run based on this proportion and the results are shown below.



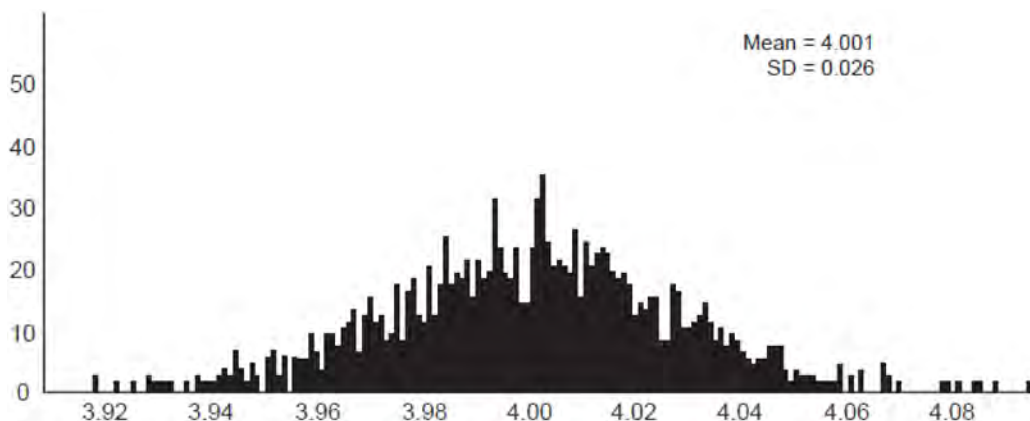
Suppose a sample of 150 students from your high school showed that 88% of students had purchased apps on their smartphones in the past 3 months. Based on the simulation, would the results from your high school give the app design company reason to believe their assumption is *incorrect*? Explain.

- 714 Robin flips a coin 100 times. It lands heads up 43 times, and she wonders if the coin is unfair. She runs a computer simulation of 750 samples of 100 fair coin flips. The output of the proportion of heads is shown below.



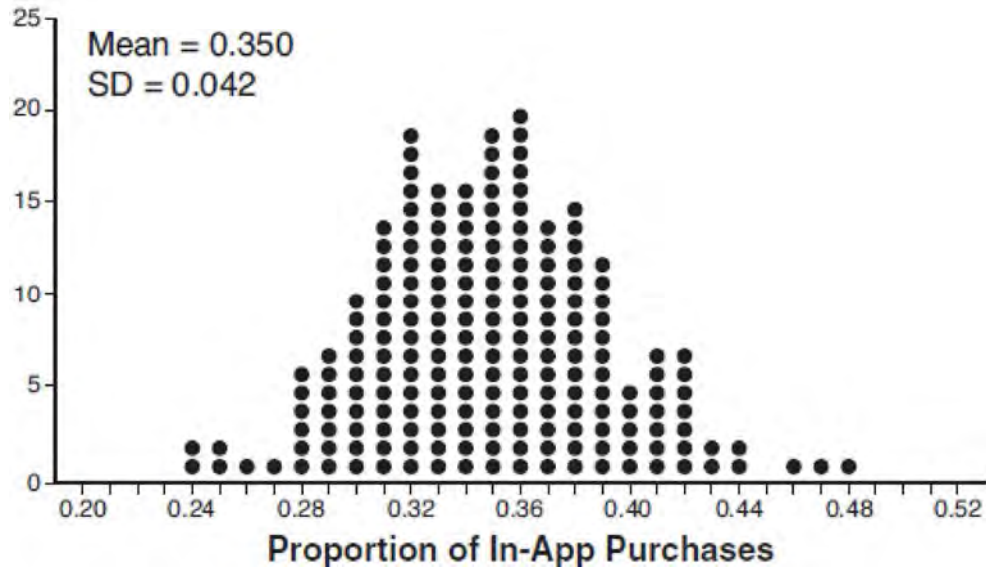
Do the results of the simulation provide strong evidence that Robin's coin is unfair? Explain your answer.

- 715 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



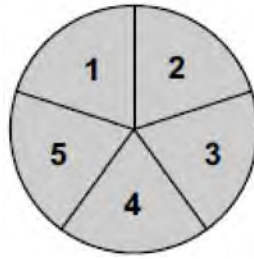
Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

- 716 Some smart-phone applications contain "in-app" purchases, which allow users to purchase special content within the application. A random sample of 140 users found that 35 percent made in-app purchases. A simulation was conducted with 200 samples of 140 users assuming 35 percent of the samples make in-app purchases. The approximately normal results are shown below.

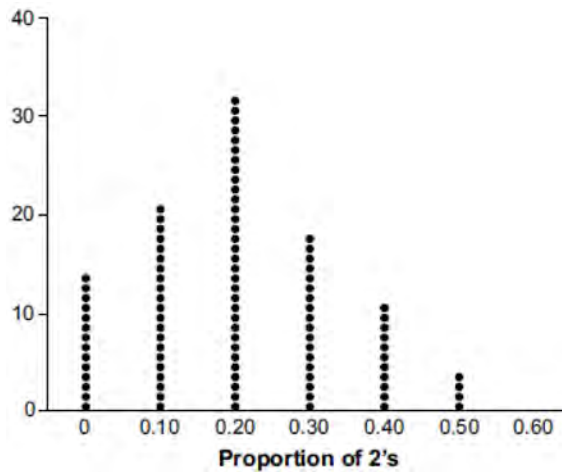


Considering the middle 95% of the data, determine the margin of error, to the *nearest hundredth*, for the simulated results. In the given context, explain what this value represents.

717 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.

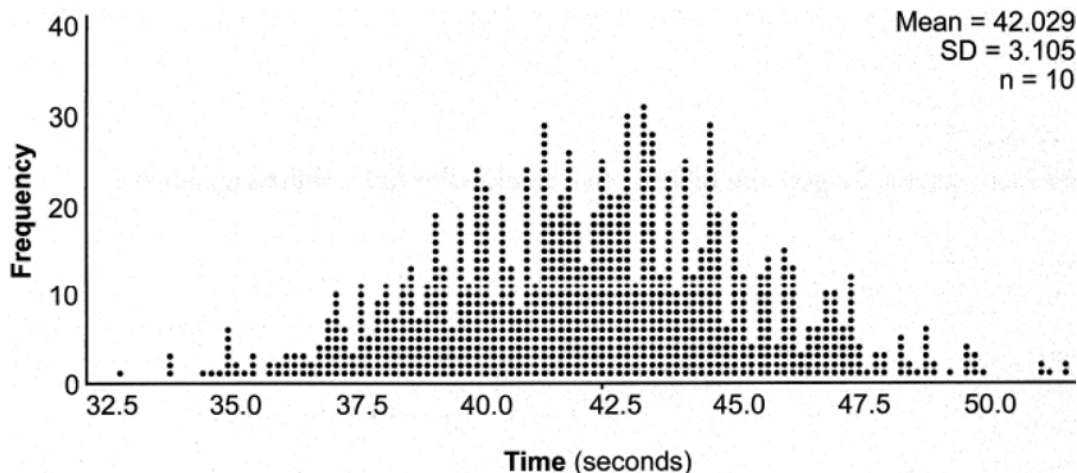


She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game. State the proportion of 2's that were spun. State the theoretical probability of spinning a 2. The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.



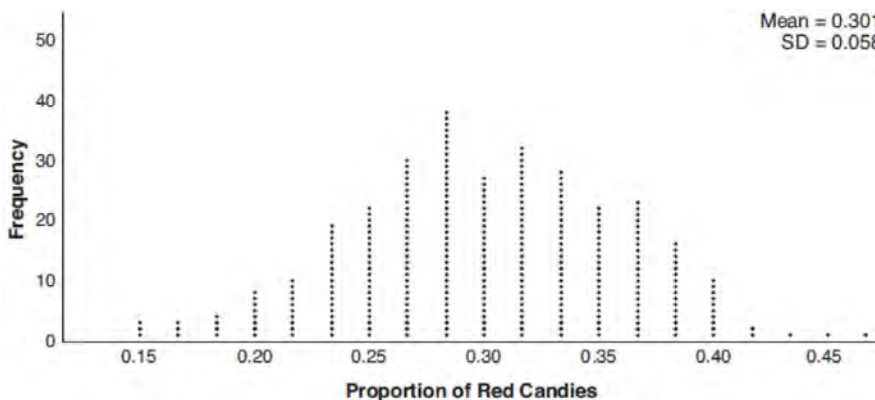
Does the output indicate that the carnival game was unfair? Explain your answer.

718 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds. The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



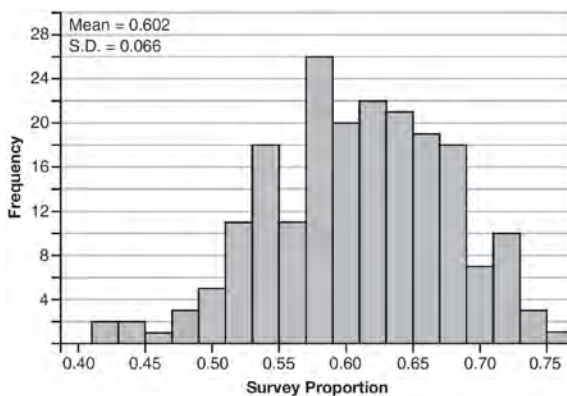
Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*. Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

719 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



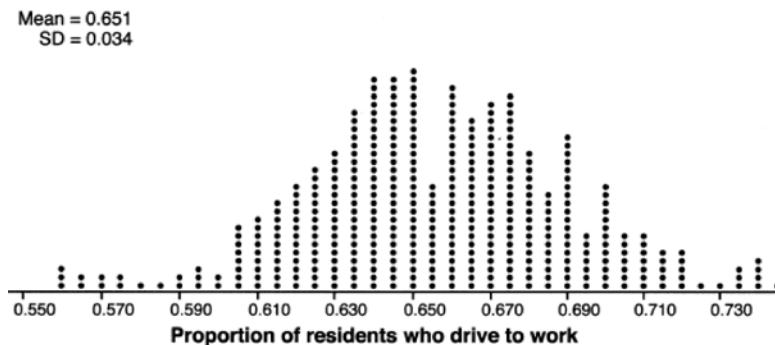
Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within. Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

- 720 Fifty-five students attending the prom were randomly selected to participate in a survey about the music choice at the prom. Sixty percent responded that a DJ would be preferred over a band. Members of the prom committee thought that the vote would have 50% for the DJ and 50% for the band. A simulation was run 200 times, each of sample size 55, based on the premise that 60% of the students would prefer a DJ. The approximate normal simulation results are shown below.



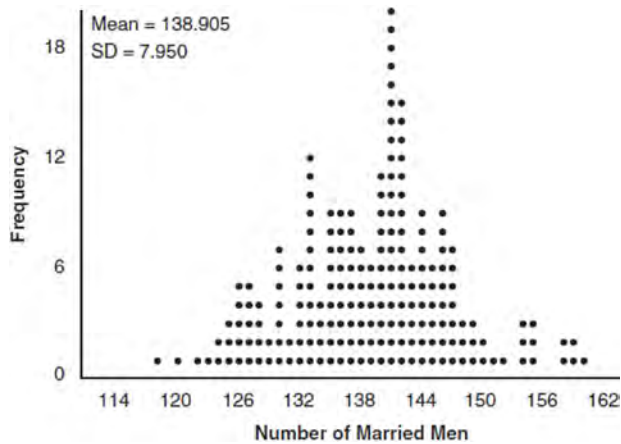
Using the results of the simulation, determine a plausible interval containing the middle 95% of the data. Round all values to the *nearest hundredth*. Members of the prom committee are concerned that a vote of all students attending the prom may produce a 50% – 50% split. Explain what statistical evidence supports this concern.

- 721 In order to decrease the percentage of its residents who drive to work, a large city launches a campaign to encourage people to use public transportation instead. Before starting the campaign, the city's Department of Transportation uses census data to estimate that 65% of its residents drive to work. The Department of Transportation conducts a simulation, shown below, run 400 times based on this estimate. Each dot represents the proportion of 200 randomly selected residents who drive to work.



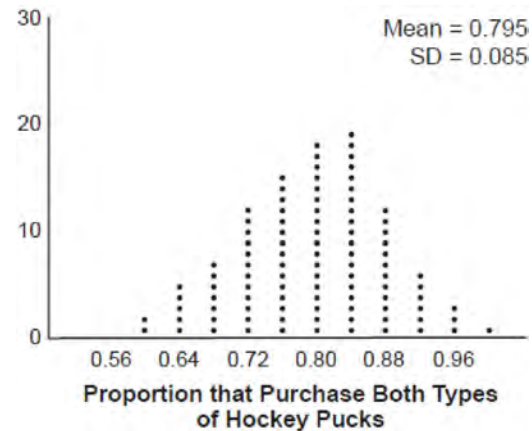
Use the simulation results to construct a plausible interval containing the middle 95% of the data. Round your answer to the *nearest hundredth*. One year after launching the campaign, the Department of Transportation conducts a survey of 200 randomly selected city residents and finds that 122 of them drive to work. Should the department conclude that the city's campaign was effective? Use statistical evidence from the simulation to explain your answer.

722 In a random sample of 250 men in the United States, age 21 or older, 139 are married. The graph below simulated samples of 250 men, 200 times, assuming that 139 of the men are married.



- Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the *nearest integer*.
- A study claims "50 percent of men 21 and older in the United States are married." Do your results from part a contradict this claim? Explain.

723 A sporting goods manufacturer is trying to determine if they should continue to produce multiple types of hockey pucks. The company surveyed 50 randomly chosen customers and asked them if they purchased both game regulation pucks and lighter training pucks. Of those surveyed, 40 of them said that they purchase both types of pucks. A simulation that was run 100 times based on the survey results produced the approximately normal results below.

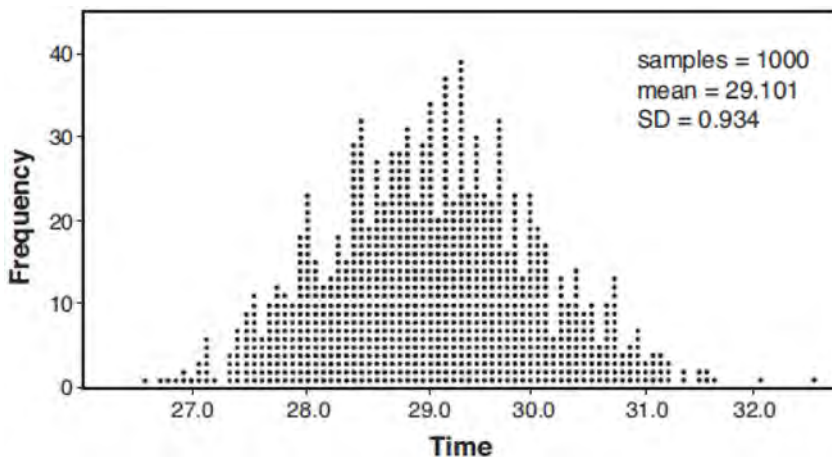


- Determine an interval containing the middle 95% of plausible values that estimates the proportion of all customers who would purchase both types of pucks from the company.
- The company will continue to manufacture both types of hockey pucks if it is reasonable to assume that the true proportion of customers who buy both types of hockey pucks is above 0.60. Using the interval from part a, explain whether or not the company should continue to produce both types of hockey pucks.

- 724 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

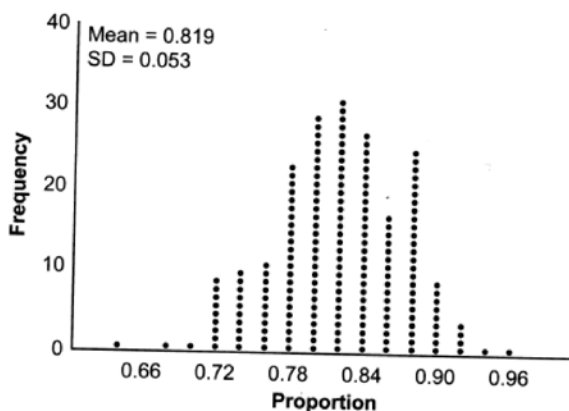
\bar{x}	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.



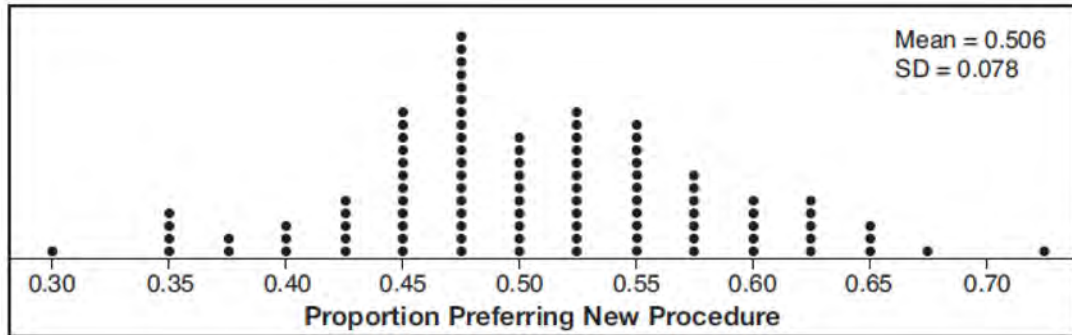
Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

- 725 State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.



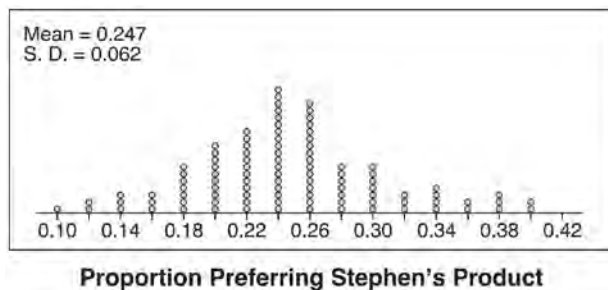
Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the *nearest thousandth*. The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials' claim.

- 726 Charlie's Automotive Dealership is considering implementing a new check-in procedure for customers who are bringing their vehicles for routine maintenance. The dealership will launch the procedure if 50% or more of the customers give the new procedure a favorable rating when compared to the current procedure. The dealership devises a simulation based on the minimal requirement that 50% of the customers prefer the new procedure. Each dot on the graph below represents the proportion of the customers who preferred the new check-in procedure, each of sample size 40, simulated 100 times.



Assume the set of data is approximately normal and the dealership wants to be 95% confident of its results. Determine an interval containing the plausible sample values for which the dealership will launch the new procedure. Round your answer to the *nearest hundredth*. Forty customers are selected randomly to undergo the new check-in procedure and the proportion of customers who prefer the new procedure is 32.5%. The dealership decides *not* to implement the new check-in procedure based on the results of the study. Use statistical evidence to explain this decision.

- 727 Stephen's Beverage Company is considering whether to produce a new brand of cola. The company will launch the product if at least 25% of cola drinkers will buy the product. Fifty cola drinkers are randomly selected to take a blind taste-test of products *A*, *B*, and the new product. Nine out of fifty participants preferred Stephen's new cola to products *A* and *B*. The company then devised a simulation based on the requirement that 25% of cola drinkers will buy the product. Each dot in the graph shown below represents the proportion of people who preferred Stephen's new product, each of sample size 50, simulated 100 times.



Assume the set of data is approximately normal and the company wants to be 95% confident of its results. Does the sample proportion obtained from the blind taste-test, nine out of fifty, fall within the margin of error developed from the simulation? Justify your answer. The company decides to continue developing the product even though only nine out of fifty participants preferred its brand of cola in the taste-test. Describe how the simulation data could be used to support this decision.

S.IC.B.3: ANALYSIS OF DATA

- 728 Which investigation technique is most often used to determine if a single variable has an impact on a given population?
- 1 observational study
 - 2 random survey
 - 3 controlled experiment
 - 4 formal interview
- 729 Which investigation technique is most often used to determine the cause and effect of a medication?
- 1 observational study
 - 2 survey
 - 3 controlled experiment
 - 4 census
- 730 A teacher randomly divides all of her students into two groups. She grades the homework for one group but does not grade the homework for the other group. All homework is returned to the students. She then compares test scores for each of the groups to see if grading homework has an effect on the test scores. This method of data collection is best described as
- 1 an experiment
 - 2 an unbiased survey
 - 3 a simulation
 - 4 an observational study
- 731 Mary would like to determine if there is an association between a student's height and shoe size. She measures the height and shoe size of every 10th person entering her school. This is an example of
- 1 a census
 - 2 an observational study
 - 3 a simulation
 - 4 a controlled experiment
- 732 A researcher randomly divides 50 bean plants into two groups. He puts one group by a window to receive natural light and the second group under artificial light. He records the growth of the plants weekly. Which data collection method is described in this situation?
- 1 observational study
 - 2 controlled experiment
 - 3 survey
 - 4 systematic sample

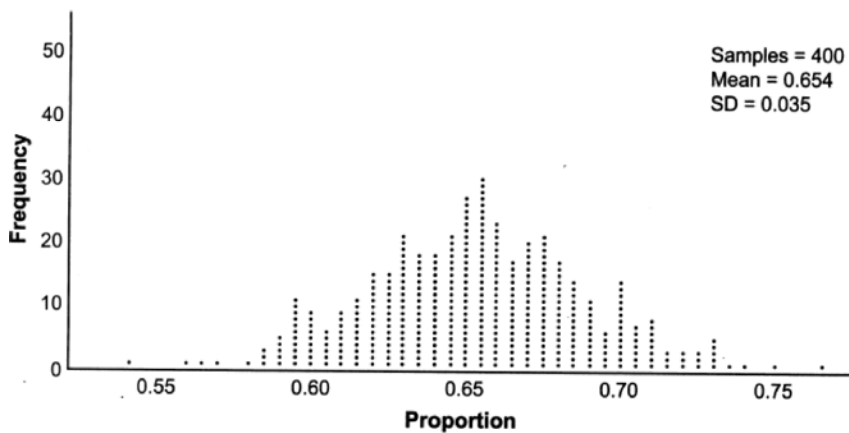
- 733 A sociologist reviews randomly selected surveillance videos from a public park over a period of several years and records the amount of time people spent on a smartphone. The statistical procedure the sociologist used is called
- 1 a census
 - 2 an experiment
 - 3 an observational study
 - 4 a sample survey
- 734 A veterinary pharmaceutical company plans to test a new drug to treat a common intestinal infection among puppies. The puppies are randomly assigned to two equal groups. Half of the puppies will receive the drug, and the other half will receive a placebo. The veterinarians monitor the puppies. This is an example of which study method?
- 1 census
 - 2 observational study
 - 3 survey
 - 4 controlled experiment
- 735 A researcher wants to determine if room-darkening shades cause people to sleep longer. Which method of data collection is most appropriate?
- 1 census
 - 2 survey
 - 3 observation study
 - 4 controlled experiment
- 736 A grocery store owner wonders how many customers bring reusable bags to the store. An employee stands at the store entrance for two hours and counts the number of people bringing in reusable bags. This type of study is best classified as
- 1 a census
 - 2 an experiment
 - 3 an observational study
 - 4 a survey
- 737 In watching auditions for lead singer in a band, Liem became curious as to whether there is an association between how animated the lead singer is and the amount of applause from the audience. He decided to watch each singer and rate the singer on a scale of 1 to 5, where 1 is the least animated and 5 is the most animated. He did this for all 5 nights of auditions and found that the more animated singers did receive louder applause. The study Liem conducted would be best described as
- 1 experimental
 - 2 observational
 - 3 a sample survey
 - 4 a random assignment
- 738 A cafeteria food manager studied the lunchtime eating habits of a group of employees in their office building. The purpose of the study was to determine the proportion of employees who purchased lunch in the cafeteria, brought their lunch from home, or purchased lunch from an outside vendor. This collection of data would best be classified as
- 1 a census
 - 2 an experiment
 - 3 an observational study
 - 4 a simulation

- 739 Which scenario is best described as an observational study?
- 1 For a class project, students in Health class ask every tenth student entering the school if they eat breakfast in the morning.
 - 2 A social researcher wants to learn whether or not there is a link between attendance and grades. She gathers data from 15 school districts.
 - 3 A researcher wants to learn whether or not there is a link between children's daily amount of physical activity and their overall energy level. During lunch at the local high school, she distributed a short questionnaire to students in the cafeteria.
 - 4 Sixty seniors taking a course in Advanced Algebra Concepts are randomly divided into two classes. One class uses a graphing calculator all the time, and the other class never uses graphing calculators. A guidance counselor wants to determine whether there is a link between graphing calculator use and students' final exam grades.
- 740 Which statement about data collection is most accurate?
- 1 A survey about parenting styles given to every tenth student entering the library will provide unbiased results.
 - 2 An observational study allows a researcher to determine the cause of an outcome.
 - 3 Margin of error increases as sample size increases.
 - 4 A survey collected from a random sample of students in a school can be used to represent the opinions of the school population.
- 741 Which statement about statistical analysis is *false*?
- 1 Experiments can suggest patterns and relationships in data.
 - 2 Experiments can determine cause and effect relationships.
 - 3 Observational studies can determine cause and effect relationships.
 - 4 Observational studies can suggest patterns and relationships in data.
- 742 According to a study, 45% of Americans have type O blood. If a random number generator produces three-digit values from 000 to 999, which values would represent those having type O blood?
- 1 between 000 and 045, inclusive
 - 2 between 000 and 444, inclusive
 - 3 between 000 and 449, inclusive
 - 4 between 000 and 450, inclusive
- 743 Abby is told that each day there is a 50% chance it will rain. Which simulation can Abby perform to determine the likelihood of it raining for the next seven days?
- 1 Flip a coin seven times, count how many heads, and repeat 50 times.
 - 2 Roll a die seven times, count how many twos, and repeat 50 times.
 - 3 Roll a pair of dice, count totals of seven, and repeat 50 times.
 - 4 Flip a coin 50 times and count how many heads.
- 744 Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

S.IC.B.4: ANALYSIS OF DATA

- 745 Four different surveys gathered data about the purchasing behaviors of pet owners. Pet owners from the same population were randomly selected. While collecting data, Chris surveyed 942 pet owners, John surveyed 410, Brooke surveyed 800, and Shane surveyed 100. Whose survey will likely have the *smallest* margin of error?
- 1 Brooke
 - 2 Chris
 - 3 John
 - 4 Shane

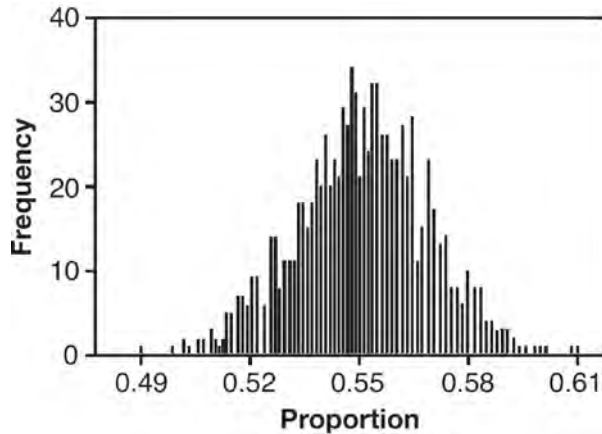
746 Betty conducted a survey of her class to see if they like pizza. She gathered 200 responses and 65% of the voters said they did like pizza. Betty then ran a simulation of 400 more surveys, each with 200 responses, assuming that 65% of the voters would like pizza. The output of the simulation is shown below.



Considering the middle 95% of the data, what is the margin of error for the simulation?

- | | | | |
|---|------|---|------|
| 1 | 0.01 | 3 | 0.05 |
| 2 | 0.02 | 4 | 0.07 |

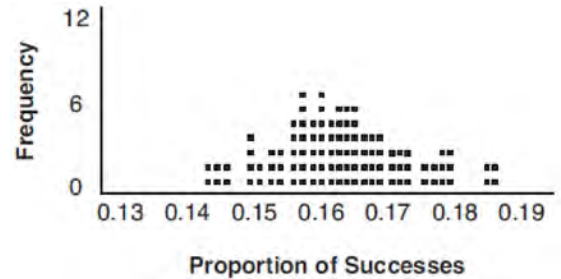
747 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The output of the simulation is shown in the diagram below.



Given this output, and assuming a 95% confidence level, the margin of error for the poll is closest to

- 1 0.01
- 2 0.03
- 3 0.06
- 4 0.12

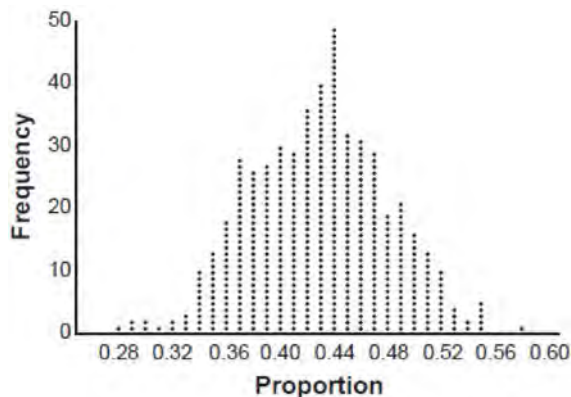
748 A study conducted in 2004 in New York City found that 212 out of 1334 participants had hypertension. Kim ran a simulation of 100 studies based on these data. The output of the simulation is shown in the diagram below.



At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to

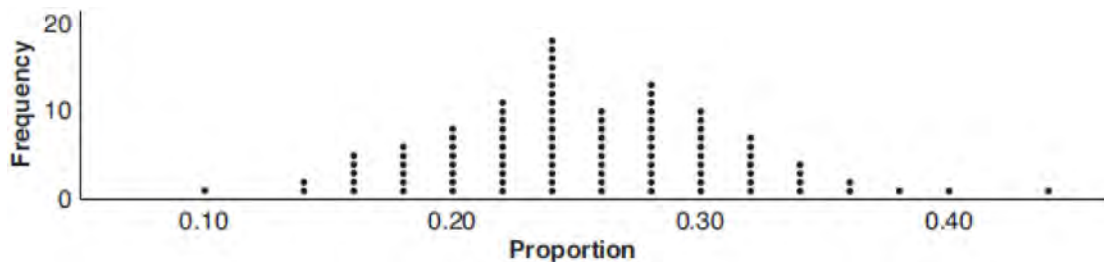
- 1 proportion $\approx .16$; margin of error $\approx .01$
- 2 proportion $\approx .16$; margin of error $\approx .02$
- 3 proportion $\approx .01$; margin of error $\approx .16$
- 4 proportion $\approx .02$; margin of error $\approx .16$

- 749 Marissa and Sydney are trying to determine if there is enough interest in their school to put on a senior musical. They randomly surveyed 100 members of the senior class and 43% of them said they would be interested in being in a senior musical. Marissa and Sydney then conducted a simulation of 500 more surveys, each of 100 seniors, assuming that 43% of the senior class would be interested in being in the musical. The output of the simulation is shown below.



- The standard deviation of the simulation is closest to
- 1 0.02
 - 2 0.05
 - 3 0.09
 - 4 0.43

- 750 A group of students was trying to determine the proportion of candies in a bag that are blue. The company claims that 24% of candies in bags are blue. A simulation was run 100 times with a sample size of 50, based on the premise that 24% of the candies are blue. The approximately normal results of the simulation are shown in the dot plot below.

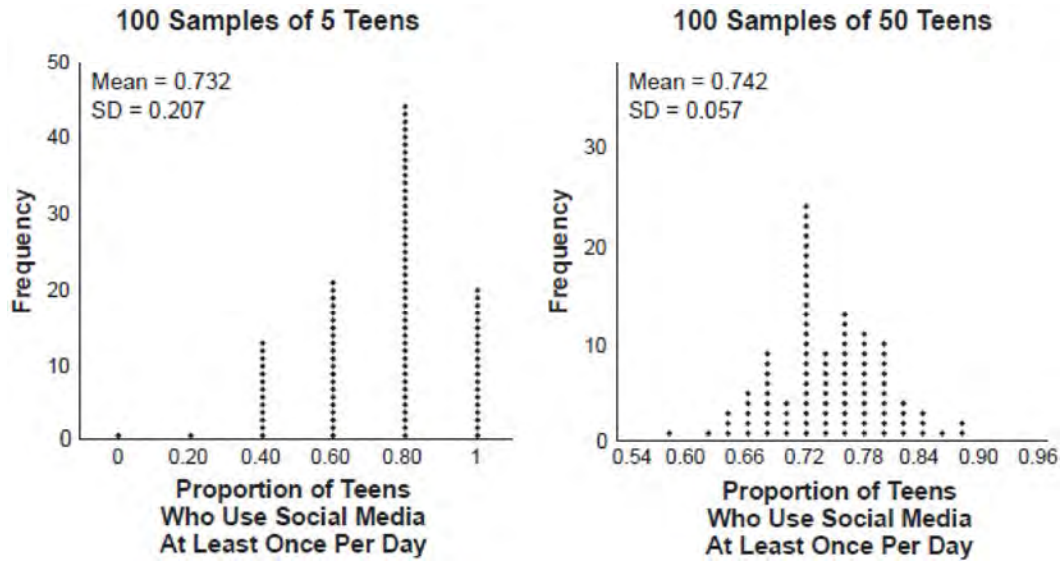


- The simulation results in a mean of 0.254 and a standard deviation of 0.060. Based on this simulation, what is a plausible interval containing the middle 95% of the data?
- 1 (0.194, 0.314)
 - 2 (0.134, 0.374)
 - 3 (-0.448, 0.568)
 - 4 (0.254, 0.374)

S.IC.B.6: ANALYSIS OF DATA

- 751 A company wishes to determine the cooking time for one pound of spaghetti. The company's technicians cooked one pound of spaghetti and recorded the time needed for the spaghetti to be ready to eat. Repeating this process 35 times resulted in an approximately normal distribution, with a mean of 9.82 minutes and a standard deviation of 1.4 minutes. In which interval should the middle 95% of cooking times fall?
- 1 (8.42, 11.22)
 - 2 (7.02, 12.62)
 - 3 (9.35, 10.29)
 - 4 (6.82, 11.32)
- 752 A public opinion poll was conducted on behalf of Mayor Ortega's reelection campaign shortly before the election. 264 out of 550 likely voters said they would vote for Mayor Ortega; the rest said they would vote for his opponent. Which statement is *least* appropriate to make, according to the results of the poll?
- 1 There is a 48% chance that Mayor Ortega will win the election.
 - 2 The point estimate (\hat{p}) of voters who will vote for Mayor Ortega is 48%.
 - 3 It is most likely that between 44% and 52% of voters will vote for Mayor Ortega.
 - 4 Due to the margin of error, an inference cannot be made regarding whether Mayor Ortega or his opponent is most likely to win the election.
- 753 The Hot and Tasty Coffee chain conducts a survey of its customers at its location at the Staten Island ferry terminal. After the survey is completed, the statistical consultant states that 70% of customers who took the survey said the most important factor in choosing where to get their coffee is how fast they are served. Based on this result, Hot and Tasty Coffee can infer that
- 1 most of its customers in New York State care most about being served quickly
 - 2 coffee drinkers care less about taste and more about being served quickly
 - 3 most of its customers at the Staten Island ferry terminal care most about being served quickly
 - 4 most of its customers at transportation terminals and stations care most about being served quickly

754 Two surveys were conducted to estimate the proportion of teens who use social media at least once per day.



Based on these results, it was determined that approximately 75% of teens use social media at least once per day. What is the best explanation of the difference in the results between the two surveys?

- | | | | |
|---|--|---|---|
| 1 | The smaller sample size of five teens resulted in a smaller margin of error and should provide a more accurate estimate. | 3 | The larger sample size of 50 teens resulted in a smaller margin of error and should provide a more accurate estimate. |
| 2 | The smaller sample size of five teens resulted in a bigger margin of error and should provide a more accurate estimate. | 4 | The larger sample size of 50 teens resulted in a bigger margin of error and should provide a more accurate estimate. |

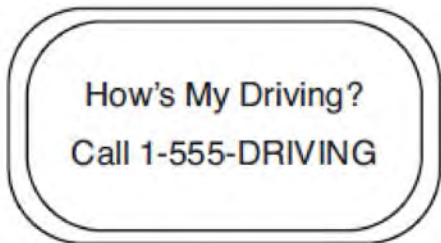
755 A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.

756 An orange-juice processing plant receives a truckload of oranges. The quality control team randomly chooses three pails of oranges, each containing 50 oranges, from the truckload. Identify the sample and the population in the given scenario. State *one* conclusion that the quality control team could make about the population if 5% of the sample was found to be unsatisfactory.

757 Elizabeth waited for 6 minutes at the drive thru at her favorite fast-food restaurant the last time she visited. She was upset about having to wait that long and notified the manager. The manager assured her that her experience was very unusual and that it would not happen again. A study of customers commissioned by this restaurant found an approximately normal distribution of results. The mean wait time was 226 seconds and the standard deviation was 38 seconds. Given these data, and using a 95% level of confidence, was Elizabeth's wait time unusual? Justify your answer.

- 758 Cheap and Fast gas station is conducting a consumer satisfaction survey. Which method of collecting data would most likely lead to a biased sample?
- 1 interviewing every 5th customer to come into the station
 - 2 interviewing customers chosen at random by a computer at the checkout
 - 3 interviewing customers who call an 800 number posted on the customers' receipts
 - 4 interviewing every customer who comes into the station on a day of the week chosen at random out of a hat
- 759 The operator of the local mall wants to find out how many of the mall's employees make purchases in the food court when they are working. She hopes to use these data to increase the rent and attract new food vendors. In total, there are 1023 employees who work at the mall. The best method to obtain a random sample of the employees would be to survey
- 1 all 170 employees at each of the larger stores
 - 2 50% of the 90 employees of the food court
 - 3 every employee
 - 4 every 30th employee entering each mall entrance for one week
- 760 A random sample of 100 people that would best estimate the proportion of all registered voters in a district who support improvements to the high school football field should be drawn from registered voters in the district at a
- 1 football game
 - 2 supermarket
 - 3 school fund-raiser
 - 4 high school band concert
- 761 Mrs. Favata's statistics class wants to conduct a survey to see how students feel about changing the school mascot's name. Which plan is the best process for gathering an appropriate sample?
- 1 Survey students in a random sample of senior homerooms.
 - 2 Survey every tenth student entering art classes in the school.
 - 3 Survey every fourth student entering the cafeteria during each lunch period.
 - 4 Survey all members of the school's varsity sports teams.
- 762 A group of high school students wanted to collect information on how many times per week students exercised. If they want the *least* biased results they should survey every fifth student at the school who is
- 1 entering the gym
 - 2 in the junior class
 - 3 entering the library
 - 4 entering the building
- 763 Which statement(s) about statistical studies is true?
- I. A survey of all English classes in a high school would be a good sample to determine the number of hours students throughout the school spend studying.
 - II. A survey of all ninth graders in a high school would be a good sample to determine the number of student parking spaces needed at that high school.
 - III. A survey of all students in one lunch period in a high school would be a good sample to determine the number of hours adults spend on social media websites.
 - IV. A survey of all Calculus students in a high school would be a good sample to determine the number of students throughout the school who don't like math.
- 1 I, only
 - 2 II, only
 - 3 I and III
 - 4 III and IV

- 764 Chuck's Trucking Company has decided to initiate an Employee of the Month program. To determine the recipient, they put the following sign on the back of each truck.



- 765 In an attempt to get the student body's opinion of a new dress code, members of the statistics class surveyed the-students of the first period computer science class. Explain a statistical bias in the method of data collection.

- 766 The business office of a local college wishes to determine the methods of payment that will be used by students when buying books at the beginning of a semester. Explain how the office can gather an appropriate sample that minimizes bias.

The driver who receives the highest number of positive comments will win the recognition. Explain *one* statistical bias in this data collection method.

S.ID.B.6: REGRESSION

- 767 The number of bacteria in a sample, which can be modeled by an exponential regression, is shown in the table below.

Time Since Observation Began (hours)	0	1	2	3.5	4
Number of Bacteria	40	48	57	75	82

Assuming this trend continues, approximately how many bacteria would be present 8 hours after the observation began?

- | | | | |
|---|-----|---|-----|
| 1 | 123 | 3 | 168 |
| 2 | 127 | 4 | 180 |

- 768 A popular celebrity tracks the number of people, in thousands, who have followed her on social media since January 1, 2015. A summary of the data she recorded is shown in the table below:

Number of Months Since January 2015	2	11	16	20	27	35	47	50	52
Number of Social Media Followers (thousands)	3.1	7.5	29.7	49.7	200.3	680.3	5200.3	8109.3	12,107.1

The celebrity uses an exponential regression equation to model the data. According to the model, about how many followers did she have on June 1, 2018?

- | | | | |
|---|------------|---|-----------|
| 1 | 13,000,000 | 3 | 1,850,000 |
| 2 | 5,420,000 | 4 | 790,000 |

769 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth*.

770 A runner is using a nine-week training app to prepare for a "fun run." The table below represents the amount of the program completed, A , and the distance covered in a session, D , in miles.

A	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
D	2	2	2.25	3	3.25

Based on these data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program.

771 A cup of coffee is left out on a countertop to cool. The table below represents the temperature, $F(t)$, in degrees Fahrenheit, of the coffee after it is left out for t minutes.

t	0	5	10	15	20	25
F(t)	180	144	120	104	93.3	86.2

Based on these data, write an exponential regression equation, $F(t)$, to model the temperature of the coffee. Round all values to the *nearest thousandth*.

772 Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Hours (x)	Average Number of Spores (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest quarter hour*, that the meat can be kept at room temperature safely.

Algebra II Regents Exam Questions by State Standard: Topic

www.jmap.org

773 The table below gives air pressures in kPa at selected altitudes above sea level measured in kilometers.

x	Altitude (km)	0	1	2	3	4	5
y	Air Pressure (kPa)	101	90	79	70	62	54

Write an exponential regression equation that models these data rounding all values to the *nearest thousandth*. Use this equation to algebraically determine the altitude, to the *nearest hundredth* of a kilometer, when the air pressure is 29 kPa.

774 The gross domestic product (GDP) per capita measures worldwide economic output per person. The GDP per capita, y , in dollars, x years after 1990 is listed in the table below.

x	y
1	9680
6	10,201
18	13,713
25	15,552
29	16,976

(a) Based on these data, write an exponential regression equation to model the GDP per capita, in dollars, x years after 1990. Round all coefficients to the *nearest hundredth*. (b) Use the rounded equation from part a to algebraically determine, to the *nearest tenth of a year*, the number of years after 1990 when GDP per capita was \$15,000.

775 The cost, in dollars, of a single-ride fare in the New York City subway in the years since 1904 is listed in the table below.

Years since 1904 (x)	0	49	72	91	99	111
Fare (y)	\$0.05	\$0.15	\$0.50	\$1.50	\$2.00	\$2.75

Which equation best models the cost of a single-ride fare based on these data?

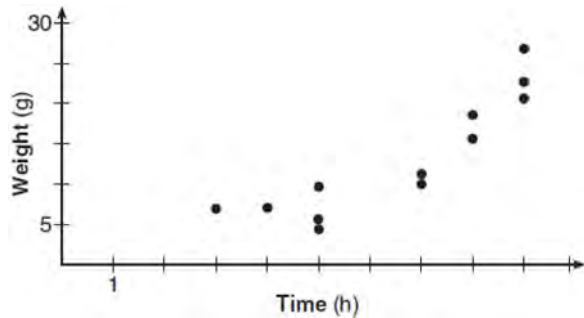
1 $y = 0.0375(1.0392)^x$

3 $y = 0.0234x - 0.487$

2 $y = 1.0392(0.0375)^x$

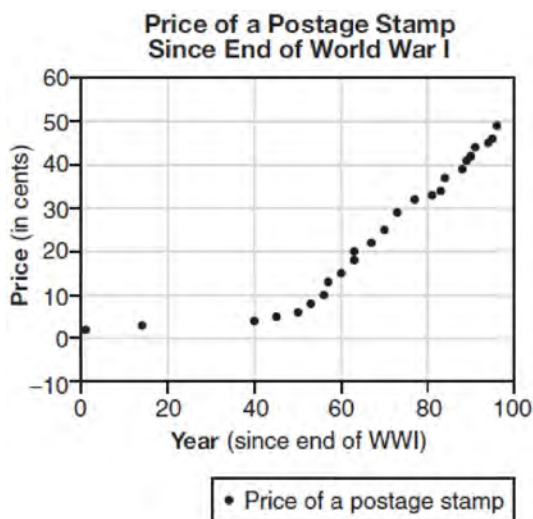
4 $y = -0.179 + 0.356 \ln(x)$

- 776 A scatterplot showing the weight, w , in grams, of each crystal after growing t hours is shown below.



The relationship between weight, w , and time, t , is best modeled by

- 1 $w = 4^t + 5$
 - 2 $w = (1.4)^t + 2$
 - 3 $w = 5(2.1)^t$
 - 4 $w = 8(.75)^t$
- 777 The price of a postage stamp in the years since the end of World War I is shown in the scatterplot below.



The equation that best models the price, in cents, of a postage stamp based on these data is

- 1 $y = 0.59x - 14.82$
- 2 $y = 1.04(1.43)^x$
- 3 $y = 1.43(1.04)^x$
- 4 $y = 24 \sin(14x) + 25$

S.ID.A.4: NORMAL DISTRIBUTIONS

- 778 Suppose two sets of test scores have the same mean, but different standard deviations, σ_1 and σ_2 , with $\sigma_2 > \sigma_1$. Which statement best describes the variability of these data sets?
- 1 Data set one has the greater variability.
 - 2 Data set two has the greater variability.
 - 3 The variability will be the same for each data set.
 - 4 No conclusion can be made regarding the variability of either set.
- 779 The job satisfaction rating at a company is approximately normally distributed with a mean of 12. About 95% of the scores are between 8 and 16. What is the standard deviation of this distribution? Justify your answer.
- 780 The heights of women in the United States are normally distributed with a mean of 64 inches and a standard deviation of 2.75 inches. The percent of women whose heights are between 64 and 69.5 inches, to the *nearest whole percent*, is
- 1 6
 - 2 48
 - 3 68
 - 4 95
- 781 A manufacturer claims that the number of ounces of a beverage dispensed by one of its automatic dispensers is normally distributed with a mean of 8.0 ounces and a standard deviation of 0.04 ounces. To the *nearest tenth of a percent*, what percent of the cups filled by this company's dispenser will contain between 7.9 and 8.11 ounces?
- 1 99.5
 - 2 99.4
 - 3 99.1
 - 4 97.6
- 782 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120. Determine the percentage of scores between 690 and 900, to the *nearest percent*.

Algebra II Regents Exam Questions by State Standard: Topic

www.jmap.org

- 783 The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the *nearest percent*, who are between 67 inches and 72 inches tall.
- 784 A population is normally distributed with a mean of 23 and a standard deviation of 1.2. The percentage of the population that falls below 21, to the *nearest hundredth*, is
- 1 0.05
 - 2 4.78
 - 3 8.29
 - 4 91.30
- 785 The distribution of the diameters of ball bearings made under a given manufacturing process is normally distributed with a mean of 4 cm and a standard deviation of 0.2 cm. What proportion of the ball bearings will have a diameter less than 3.7 cm?
- 1 0.0668
 - 2 0.4332
 - 3 0.8664
 - 4 0.9500
- 786 The mean intelligence quotient (IQ) score is 100, with a standard deviation of 15, and the scores are normally distributed. Given this information, the approximate percentage of the population with an IQ greater than 130 is closest to
- 1 2%
 - 2 31%
 - 3 48%
 - 4 95%
- 787 The number of hours in the lifespan of a certain brand of light bulb is normally distributed with a mean of 2387 hours and a standard deviation of 238 hours. To the *nearest tenth of a percent*, what percent of light bulbs have a lifespan of greater than 2750 hours?
- 1 6.4%
 - 2 15.9%
 - 3 43.6%
 - 4 93.6%
- 788 The heights of the students at Central High School can be modeled by a normal distribution with a mean of 68.1 and a standard deviation of 3.4 inches. According to this model, approximately what percent of the students would have a height less than 60 inches or greater than 75 inches?
- 1 0.86%
 - 2 1.26%
 - 3 2.12%
 - 4 2.98%
- 789 The weight of a bag of pears at the local market averages 8 pounds with a standard deviation of 0.5 pound. The weights of all the bags of pears at the market closely follow a normal distribution. Determine what percentage of bags, to the *nearest integer*, weighed *less* than 8.25 pounds.
- 790 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.
- 791 The lifespan of a 60-watt lightbulb produced by a company is normally distributed with a mean of 1450 hours and a standard deviation of 8.5 hours. If a 60-watt lightbulb produced by this company is selected at random, what is the probability that its lifespan will be between 1440 and 1465 hours?
- 1 0.3803
 - 2 0.4612
 - 3 0.8415
 - 4 0.9612
- 792 The weights of bags of Graseck's Chocolate Candies are normally distributed with a mean of 4.3 ounces and a standard deviation of 0.05 ounces. What is the probability that a bag of these chocolate candies weighs less than 4.27 ounces?
- 1 0.2257
 - 2 0.2743
 - 3 0.7257
 - 4 0.7757

Algebra II Regents Exam Questions by State Standard: Topic

www.jmap.org

- 793 Two versions of a standardized test are given, an April version and a May version. The statistics for the April version show a mean score of 480 and a standard deviation of 24. The statistics for the May version show a mean score of 510 and a standard deviation of 20. Assume the scores are normally distributed. Joanne took the April version and scored in the interval 510-540. What is the probability, to the *nearest ten thousandth*, that a test paper selected at random from the April version scored in the same interval? Maria took the May version. In what interval must Maria score to claim she scored as well as Joanne?
- 794 In 2013, approximately 1.6 million students took the Critical Reading portion of the SAT exam. The mean score, the modal score, and the standard deviation were calculated to be 496, 430, and 115, respectively. Which interval reflects 95% of the Critical Reading scores?
- 1 430 ± 115
 - 2 430 ± 230
 - 3 496 ± 115
 - 4 496 ± 230
- 795 In a small city, there are 22 gas stations. The mean price for a gallon of regular gas was \$2.12 with a standard deviation of \$0.05. The distribution of the data was approximately normal. Given this information, the middle 95% of the gas stations in this small city likely charge
- 1 \$1.90 to \$2.34 for a gallon of gas
 - 2 \$1.97 to \$2.27 for a gallon of gas
 - 3 \$2.02 to \$2.22 for a gallon of gas
 - 4 \$2.07 to \$2.17 for a gallon of gas
- 796 The heights of the 3300 students at Oceanview High School are approximately normally distributed with a mean of 65.5 inches and a standard deviation of 2.9 inches. The number of students at Oceanview who are between 64 and 68 inches tall is closest to
- 1 1660
 - 2 1070
 - 3 2244
 - 4 1640
- 797 There are 440 students at Thomas Paine High School enrolled in U.S. History. On the April report card, the students' grades are approximately normally distributed with a mean of 79 and a standard deviation of 7. Students who earn a grade less than or equal to 64.9 must attend summer school. The number of students who must attend summer school for U.S. History is closest to
- 1 3
 - 2 5
 - 3 10
 - 4 22
- 798 A family owned grocery store in New Hartford, NY employs 49 people whose ages are approximately normally distributed with a mean of 36 years and a standard deviation of 6.2 years. Ryan has been hired to work at this store. He is 30 years old. How many people who work at this store would you expect to be younger than Ryan?
- 1 17
 - 2 7
 - 3 41
 - 4 8
- 799 The scores on a mathematics college-entry exam are normally distributed with a mean of 68 and standard deviation 7.2. Students scoring higher than one standard deviation above the mean will not be enrolled in the mathematics tutoring program. How many of the 750 incoming students can be expected to be enrolled in the tutoring program?
- 1 631
 - 2 512
 - 3 238
 - 4 119
- 800 There are 400 students in the senior class at Oak Creek High School. All of these students took the SAT. The distribution of their SAT scores is approximately normal. The number of students who scored within 2 standard deviations of the mean is approximately
- 1 75
 - 2 95
 - 3 300
 - 4 380

- 801 The scores of a recent test taken by 1200 students had an approximately normal distribution with a mean of 225 and a standard deviation of 18. Determine the number of students who scored between 200 and 245.
- 802 According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the *nearest integer*, approximately how many babies weighed more than 4 kg.
- 803 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed. Given this information, determine the interval representing the middle 95% of student scores. To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

Algebra II Regents Exam Questions by State Standard: Topic Answer Section

1 ANS: 2

$$1) \frac{29860 - 629}{1910 - 1850} \approx 487; 2) \frac{790390 - 494290}{2010 - 1990} \approx 14805; 3) \frac{251808 - 132459}{1970 - 1950} \approx 5967; 4) \frac{251808 - 14575}{1970 - 1890} \approx 2965$$

PTS: 2 REF: 062301aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: table

2 ANS: 1

$$(1) \frac{9-0}{2-1} = 9 \quad (2) \frac{17-0}{3.5-1} = 6.8 \quad (3) \frac{0-0}{5-1} = 0 \quad (4) \frac{17--5}{3.5-1} \approx 6.3$$

PTS: 2 REF: 011724aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: graph

3 ANS: 1

TOP: Rate of Change

PTS: 2

REF: 061904aai

NAT: F.IF.B.6

KEY: graph

4 ANS: 4

$$g(x): \frac{10-6}{4-2} = 2 \quad t(x): \frac{3--5}{4-2} = 4$$

PTS: 2 REF: 062212aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: graph | table

5 ANS:

$$\frac{306.25 - 156.25}{70 - 50} = \frac{150}{20} = 7.5 \quad \text{Between 50-70 mph, each additional mph in speed requires 7.5 more feet to stop.}$$

PTS: 2 REF: 081631aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: table

6 ANS:

$$\frac{60-20}{4-2} = \frac{40}{2} = 20$$

PTS: 2 REF: 082225aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: graph

7 ANS: 4

$$(1) \frac{B(60) - B(10)}{60 - 10} \approx 28\% \quad (2) \frac{B(69) - B(19)}{69 - 19} \approx 33\% \quad (3) \frac{B(72) - B(36)}{72 - 36} \approx 38\% \quad (4) \frac{B(73) - B(60)}{73 - 60} \approx 46\%$$

PTS: 2 REF: 011721aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

8 ANS: 1

$$\frac{N(6) - N(0)}{6 - 0} \approx -8.93$$

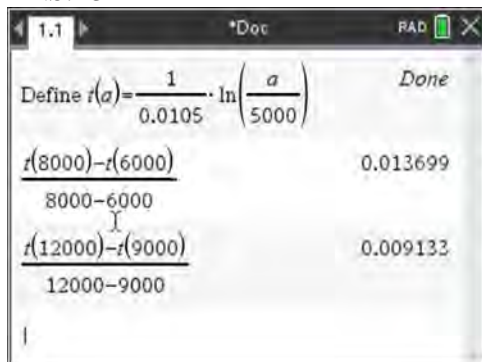
PTS: 2 REF: 012012aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

9 ANS: 1

$$\frac{N(10) - N(1)}{10 - 1} \approx -2.03, \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \frac{N(30) - N(1)}{30 - 1} \approx -1.64$$

PTS: 2 REF: 061807aia NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

10 ANS: 3



PTS: 2 REF: 081922aia NAT: F.IF.B.6 TOP: Rate of Change
KEY: logarithmic

11 ANS: 3

$$\log_{0.8} \left(\frac{V}{17000} \right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3 - 1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

PTS: 2 REF: 081709aia NAT: F.IF.B.6 TOP: Rate of Change
KEY: logarithmic

12 ANS:

$$\frac{P(10.5) - P(0)}{10.5 - 0} \approx 10.76 \text{ fruit flies per day}$$

PTS: 2 REF: 082332aia NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

13 ANS:

$$\frac{V(7) - V(2)}{7 - 2} \approx 48$$

PTS: 2 REF: 012427aia NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

14 ANS:

$$\frac{H(10) - H(2)}{10 - 2} \approx 11524 \text{ From 2014-2018, the median house price increased } \$11524 \text{ per year on average.}$$

PTS: 4 REF: 062434aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

15 ANS:

$$\frac{p(8) - p(4)}{8 - 4} \approx 48.78$$

PTS: 2 REF: 081827aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

16 ANS:

$$\frac{m(4) - m(-1)}{4 - (-1)} = \frac{81 - 1}{5} = 16 \text{ } p(x) \text{ has a greater rate of change}$$

$$\frac{p(4) - p(-1)}{4 - (-1)} = 16.1\bar{3}$$

PTS: 4 REF: 012534aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

17 ANS:

$$\frac{f(4) - f(-2)}{4 - (-2)} = \frac{80 - 1.25}{6} = 13.125 \text{ } g(x) \text{ has a greater rate of change}$$

$$\frac{g(4) - g(-2)}{4 - (-2)} = \frac{179 - (-49)}{6} = 38$$

PTS: 4 REF: 061636aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

18 ANS:

$$\text{China: } \frac{P(120) - P(50)}{120 - 50} \approx 13.5 \text{ India: } \frac{1380 - 376.3}{120 - 50} \approx 14.3 \text{ India}$$

PTS: 4 REF: 082433aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: exponential

19 ANS:

$$\frac{13.9 - 9.4}{4 - 1} = 1.5 \text{ The average rate of change in the number of hours of daylight from January 1-April 1 is 1.5.}$$

PTS: 2 REF: 061925aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: trigonometric

20 ANS: 3

$$\frac{f(7) - f(-7)}{7 - (-7)} = \frac{2^{-0.25(7)} \cdot \sin\left(\frac{\pi}{2}(7)\right) - 2^{-0.25(-7)} \cdot \sin\left(\frac{\pi}{2}(-7)\right)}{14} \approx -0.26$$

PTS: 2 REF: 061721aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: trigonometric

21 ANS:

$\frac{B(11) - B(8)}{11 - 8} \approx -10.1$ The average monthly high temperature decreases 10.1° each month from August to November.

PTS: 2 REF: 011930aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: trigonometric

22 ANS:

$\frac{B(10) - B(6)}{10 - 6} \approx -3.88$. The average monthly high temperature decreases about 4° each month from June and October.

PTS: 4 REF: 012336aai NAT: F.IF.B.6 TOP: Rate of Change
KEY: trigonometric

23 ANS: 3

$$\begin{aligned} 2(i^3)x^2 + 3(i^2)x - ix \\ 2(-i)x^2 + 3(-1)x - ix \\ -2ix^2 - 3x - ix \end{aligned}$$

PTS: 2 REF: 062506aai NAT: N.CN.A.2 TOP: Imaginary Numbers

24 ANS:

$$8xi^{10} - 4yi^{19} + 2yi^3 - 6xi = 8x(-1) - 4y(-i) + 2y(-i) - 6xi = -8x + 4yi - 2yi - 6xi = -8x + 2yi - 6xi$$

PTS: 2 REF: 082527aai NAT: N.CN.A.2 TOP: Imaginary Numbers

25 ANS: 3

$$3i(ai - 6i^2) = 3ai^2 - 18i^3 = -3a + 18i$$

PTS: 2 REF: 062307aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

26 ANS: 2

$$6xi^3(-4xi + 5) = -24x^2i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi$$

PTS: 2 REF: 061704aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

27 ANS: 3

$$-3 + 5i - (4 + 24i - 2i - 12i^2) = -3 + 5i - (16 + 22i) = -19 - 17i$$

PTS: 2 REF: 081815aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

28 ANS: 4

$$(x - 2i)(x - 2i) = x^2 - 4xi + 4i^2 = x^2 - 4xi - 4$$

PTS: 2 REF: 082202aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

29 ANS: 2

$$(2 - yi)(2 - yi) = 4 - 4yi + y^2i^2 = -y^2 - 4yi + 4$$

PTS: 2 REF: 061603aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

30 ANS: 3

$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

PTS: 2 REF: 081702aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

31 ANS: 2

$$i^2(5x - 2i)^2 = -(25x^2 - 20xi - 4)$$

PTS: 2 REF: 012512aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

32 ANS: 1

$$6 - (3x - 2i)(3x - 2i) = 6 - (9x^2 - 12xi + 4i^2) = 6 - 9x^2 + 12xi + 4 = -9x^2 + 12xi + 10$$

PTS: 2 REF: 061915aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

33 ANS: 3

$$(x + 3i)^2 - (2x - 3i)^2 = x^2 + 6xi + 9i^2 - (4x^2 - 12xi + 9i^2) = -3x^2 + 18xi$$

PTS: 2 REF: 061805aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

34 ANS: 1

$$(2x - i)^2 - (2x - i)(2x + 3i)$$

$$(2x - i)[(2x - i) - (2x + 3i)]$$

$$(2x - i)(-4i)$$

$$-8xi + 4i^2$$

$$-8xi - 4$$

PTS: 2 REF: 011911aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

35 ANS: 1

$$7 - 3i + x^2 - 4xi + 4i^2 - 4i - 2x^2 = 7 - 7i - x^2 - 4xi - 4 = 3 - x^2 - 4xi - 7i = (3 - x^2) - (4x + 7)i$$

PTS: 2 REF: 012022aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

36 ANS: 4

$$x^3 - x^2yi - xy^2 + x^2yi - xy^2i^2 - y^3i = x^3 - xy^2 - xy^2(-1) - y^3i = x^3 - y^3i$$

PTS: 2 REF: 062223aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

37 ANS: 4

$$5i(2x + 3i) - x\sqrt{-9} = 10xi + 15i^2 - 3xi = -15 + 7xi$$

PTS: 2 REF: 082415aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

38 ANS: 3

$$(6 - ki)^2 = 27 - 36i$$

$$36 - 12ki + k^2i^2 = 27 - 36i$$

$$9 - k^2 - 12ki = -36i$$

Set real part equal to real part: $9 - k^2 = 0$ Set imaginary part equal to imaginary part: $-12ki = -36i$

$$k = \pm 3$$

$$\frac{-12ki}{-12i} = \frac{-36i}{-12i}$$

$$k = 3$$

PTS: 2 REF: 012308aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

39 ANS:

$$xi(-6i)^2 = xi(36i^2) = 36xi^3 = -36xi$$

PTS: 2 REF: 081627aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

40 ANS:

$$(5xi^3 - 4i)^2 = (-5xi - 4i)^2 = 25x^2i^2 + 40xi^2 + 16i^2 = -25x^2 - 40x - 16$$

PTS: 2 REF: 082329aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

41 ANS:

$$(2xi^3 - 3y)^2 = 4x^2i^6 - 12xyi^3 + 9y^2 = -4x^2 + 12xyi + 9y^2$$

PTS: 2 REF: 012431aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

42 ANS:

$$(1 - i)(1 - i)(1 - i) = (1 - 2i + i^2)(1 - i) = -2i(1 - i) = -2i + 2i^2 = -2 - 2i$$

PTS: 2 REF: 011725aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

43 ANS:

$$3x - 2x^2i + 6i - 4xi^2 + 2x^2i = 3x + 6i + 4x = 7x + 6i$$

PTS: 2 REF: 062425aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

44 ANS:

$$(4 - 3i)(5 + 2yi - 5 + 2yi)$$

$$(4 - 3i)(4yi)$$

$$16yi - 12yi^2$$

$$12y + 16yi$$

PTS: 2 REF: spr1506aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

45 ANS:

$$-\frac{1}{2}i^3(3i-4) - 3i^2 = -\frac{3}{2}i^4 + 2i^3 - 3i^2 = -\frac{3}{2} - 2i + 3 = \frac{3}{2} - 2i$$

PTS: 2 REF: 081927aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

46 ANS:

$$i^2 = -1, \text{ and not } 1; 10 + 10i$$

PTS: 2 REF: 011825aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

47 ANS: 4

$$4x^2 = -98$$

$$x^2 = -\frac{98}{4}$$

$$x^2 = -\frac{49}{2}$$

$$x = \pm \sqrt{-\frac{49}{2}} = \pm \frac{7i}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \pm \frac{7i\sqrt{2}}{2}$$

PTS: 2 REF: 061707aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | taking square roots

48 ANS: 4

$$wx^2 + w = 0$$

$$w(x^2 + 1) = 0$$

$$x^2 = -1$$

$$x = \pm i$$

PTS: 2 REF: 061912aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | taking square roots

49 ANS: 3

$$x^2 + 2x + 1 = -5 + 1$$

$$(x + 1)^2 = -4$$

$$x + 1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2 REF: 081703aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

50 ANS: 3

$$x^2 + 6x + 9 = -10 + 9$$

$$(x + 3)^2 = -1$$

$$x + 3 = \pm i$$

$$x = -3 \pm i$$

PTS: 2 REF: 012416aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

51 ANS: 1

$$x^2 - 4x + 4 = -13 + 4$$

$$(x - 2)^2 = -9$$

$$x - 2 = \pm 3i$$

$$x = 2 \pm 3i$$

PTS: 2 REF: 062312aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

52 ANS: 3

$$-2\left(-\frac{1}{2}x^2 = -6x + 20\right)$$

$$x^2 - 12x = -40$$

$$x^2 - 12x + 36 = -40 + 36$$

$$(x - 6)^2 = -4$$

$$x - 6 = \pm 2i$$

$$x = 6 \pm 2i$$

PTS: 2 REF: fall1504aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

53 ANS: 1

$$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(2)}}{2(2)} = \frac{-3 \pm \sqrt{-7}}{4} = -\frac{3}{4} \pm \frac{i\sqrt{7}}{4}$$

PTS: 2 REF: 061612aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

54 ANS: 3

$$x = \frac{-2 \pm \sqrt{2^2 - 4(3)(7)}}{2(3)} = \frac{-2 \pm \sqrt{-80}}{6} = \frac{-2 \pm i\sqrt{16}\sqrt{5}}{6} = -\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}$$

PTS: 2 REF: 081809aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

55 ANS: 2

$$4x^2 - 7x + 8 = 0 \quad x = \frac{7 \pm \sqrt{(-7)^2 - 4(4)(8)}}{2(4)} = \frac{7 \pm \sqrt{-79}}{8}$$

PTS: 2 REF: 012507aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

56 ANS: 2

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(4)}}{2(5)} = \frac{2 \pm \sqrt{-76}}{10} = \frac{2 \pm i\sqrt{4}\sqrt{19}}{10} = \frac{1}{5} \pm \frac{i\sqrt{19}}{5}$$

PTS: 2 REF: 011905aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

57 ANS: 4

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(6)(29)}}{2(6)} = \frac{8 \pm \sqrt{-632}}{12} = \frac{8 \pm i\sqrt{4}\sqrt{158}}{12} = \frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$$

PTS: 2 REF: 011711aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

58 ANS: 2

$$3x^2 - 4x + 2 = 2x - 3 \quad x = \frac{6 \pm \sqrt{(-6)^2 - 4(3)(5)}}{2(3)} = \frac{6 \pm \sqrt{-24}}{6} = \frac{6 \pm 2i\sqrt{6}}{6} = 1 \pm \frac{i\sqrt{6}}{3}$$

$$3x^2 - 6x + 5 = 0$$

PTS: 2 REF: 062410aai NAT: A.REI.B.4 TOP: Solving Quadratics

59 ANS: 2

$$5x^2 - 4x + 2 = 0 \quad \frac{4 \pm \sqrt{(-4)^2 - 4(5)(2)}}{2(5)} = \frac{4 \pm \sqrt{-24}}{10} = \frac{4 \pm 2i\sqrt{6}}{10} = \frac{2 \pm i\sqrt{6}}{5}$$

PTS: 2 REF: 012020aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

60 ANS:

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(11)}}{2(1)} = \frac{-3 \pm \sqrt{-35}}{2} = -\frac{3}{2} \pm \frac{i\sqrt{35}}{2}$$

PTS: 2 REF: 082432aai NAT: A.REI.B.4 TOP: Solving Quadratics

61 ANS:

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(2)(1)}}{2(2)} = \frac{2 \pm \sqrt{-4}}{4} = \frac{2 \pm 2i}{4} = \frac{1}{2} \pm \frac{i}{2}$$

PTS: 2 REF: 082532aai NAT: A.REI.B.4 TOP: Solving Quadratics

62 ANS:

$$x = \frac{-5 \pm \sqrt{5^2 - 4(2)(8)}}{2(2)} = -\frac{5}{4} \pm \frac{i\sqrt{39}}{4}$$

PTS: 2 REF: 061827aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

63 ANS:

$$x = \frac{-5 \pm \sqrt{5^2 - 4(3)(8)}}{2(3)} = -\frac{5}{6} \pm \frac{i\sqrt{71}}{6}$$

PTS: 2 REF: 082327aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

64 ANS:

$x^2 - 6x = -17$ The solution is imaginary because the parabola and line do not intersect.

$$x^2 - 6x + 9 = -17 + 9$$

$$(x - 3)^2 = -8$$

$$x - 3 = \pm 2i\sqrt{2}$$

$$x = 3 \pm 2i\sqrt{2}$$

PTS: 4 REF: 081936aai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | completing the square

65 ANS: 2

1) 1 real, mult. 2; 3) not a quadratic; 4) not a function.

PTS: 2 REF: 012324aai NAT: A.REI.B.4 TOP: Using the Discriminant
KEY: determine nature of roots

66 ANS: 2 PTS: 2 REF: 012402aai NAT: A.REI.B.4
TOP: Using the Discriminant KEY: determine nature of roots

67 ANS: 3 PTS: 2 REF: 062409aai NAT: A.REI.B.4
TOP: Using the Discriminant KEY: determine nature of roots

68 ANS: 2 PTS: 2 REF: 082308aai NAT: A.REI.B.4
TOP: Using the Discriminant KEY: determine nature of roots

69 ANS: 4

(1) quadratic has two roots and both are real $(-2,0)$ and $(-0.5,0)$, (2) $x = \pm\sqrt{32} - 3$, (3) the real root is 3, with a multiplicity of 2, (4) $x = \pm 4i$

PTS: 2 REF: 011909aai NAT: A.REI.B.4 TOP: Using the Discriminant
KEY: determine nature of roots

70 ANS:

$$b^2 - 4ac = (-4)^2 - 4(1)(13) = 16 - 52 = -36 \text{ imaginary}$$

PTS: 2 REF: 062225aai NAT: A.REI.B.4 TOP: Using the Discriminant
KEY: determine nature of roots

71 ANS: 1

The product of the roots equals $(3+i)(3-i) = 9 - i^2 = 10 = \frac{c}{a}$. OR

$$(x - (3+i))(x - (3-i)) = 0$$

$$(x - 3 - i)(x - 3 + i) = 0$$

$$((x - 3) - i)((x - 3) + i) = 0$$

$$(x - 3)^2 - i^2 = 0$$

$$x^2 - 6x + 9 + 1 = 0$$

$$x^2 - 6x + 10 = 0$$

PTS: 2 REF: 082208aai NAT: A.REI.B.4 TOP: Complex Conjugate Root Theorem

72 ANS: 4

If $1 - i$ is one solution, the other is $1 + i$. $(x - (1 - i))(x - (1 + i)) = 0$

$$x^2 - x - ix - x + ix + (1 - i^2) = 0$$

$$x^2 - 2x + 2 = 0$$

PTS: 2 REF: 081601aai NAT: A.REI.B.4 TOP: Complex Conjugate Root Theorem

73 ANS: 2

$$u = x + 2 \quad u^2 + 4u + 3$$

$$(u + 3)(u + 1)$$

$$(x + 2 + 3)(x + 2 + 1)$$

$$(x + 5)(x + 3)$$

PTS: 2 REF: 081901aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: higher power

74 ANS: 1

$$u = x + 2 \quad u^2 - 5u + 6$$

$$(u - 3)(u - 2)$$

$$(x + 2 - 3)(x + 2 - 2)$$

$$(x - 1)x$$

PTS: 2 REF: 012301aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: higher power

75 ANS: 2

$$u = x + 3 \quad u^2 + 4u - 5$$

$$(u + 5)(u - 1)$$

$$(x + 3 + 5)(x + 3 - 1)$$

$$(x + 8)(x + 2)$$

PTS: 2 REF: 062401aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

76 ANS: 3

$$(x + a)^2 + 5(x + a) + 4 \quad \text{let } u = x + a$$

$$u^2 + 5u + 4$$

$$(u + 4)(u + 1)$$

$$(x + a + 4)(x + a + 1)$$

PTS: 2 REF: 012006aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: multivariable

77 ANS: 2

$$u = x - 2 \quad u^2 + 27u - 90$$

$$(u + 30)(u - 3)$$

$$(x - 2 + 30)(x - 2 - 3)$$

$$(x + 28)(x - 5)$$

PTS: 2 REF: 012503aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

78 ANS: 2

$$(x^2 + 3)^2 - 2(x^2 + 3) - 24 \quad \text{let } u = x^2 + 3$$

$$u^2 - 2u - 24$$

$$(u - 6)(u + 4)$$

$$(x^2 + 3 - 6)(x^2 + 3 + 4)$$

PTS: 2 REF: 062310aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

79 ANS: 3

$$(3x - 1)^2 - 5(3x - 1) + 6$$

$$u^2 - 5u + 6$$

$$(u - 3)(u - 2)$$

$$(3x - 1 - 3)(3x - 1 - 2)$$

$$(3x - 4)(3x - 3)$$

$$3(3x - 4)(x - 1)$$

PTS: 2 REF: 082519aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

- 80 ANS: 2 PTS: 2 REF: 081904aai NAT: A.SSE.A.2
TOP: Factoring Polynomials KEY: higher power
- 81 ANS: 4
 $m^5 + m^3 - 6m = m(m^4 + m^2 - 6) = m(m^2 + 3)(m^2 - 2)$
- PTS: 2 REF: 011703aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: higher power
- 82 ANS: 4
 $(x^6y^4 - 9)(x^4 - 16)$
 $(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$
- PTS: 2 REF: 081814aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping
- 83 ANS: 3 PTS: 2 REF: 062302aai NAT: A.SSE.A.2
TOP: Factoring Polynomials
- 84 ANS: 3
 $x^8 - y^8 = (x^4 + y^4)(x^4 - y^4) = (x^4 + y^4)(x^2 + y^2)(x^2 - y^2) = (x^4 + y^4)(x^2 + y^2)(x + y)(x - y)$
- PTS: 2 REF: 082423aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
- 85 ANS: 2
 $x(x^3 + 4x^2 - 9x - 36)$
 $x(x^2(x + 4) - 9(x + 4))$
 $x(x^2 - 9)(x + 4)$
 $x(x + 3)(x - 3)(x + 4)$
- PTS: 2 REF: 062407aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
- 86 ANS: 3
 $2d(d^3 + 3d^2 - 9d - 27)$
 $2d(d^2(d + 3) - 9(d + 3))$
 $2d(d^2 - 9)(d + 3)$
 $2d(d + 3)(d - 3)(d + 3)$
 $2d(d + 3)^2(d - 3)$
- PTS: 2 REF: 081615aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

87 ANS: 4

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$$

$$k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)$$

$$(k^2 - 4)(k^2 + 8k + 12)$$

$$(k + 2)(k - 2)(k + 6)(k + 2)$$

PTS: 2 REF: fall1505aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

88 ANS: 2

$$n^2(n^2 - 9) + 4n(n^2 - 9) - 12(n^2 - 9)$$

$$(n^2 + 4n - 12)(n^2 - 9)$$

$$(n + 6)(n - 2)(n + 3)(n - 3)$$

PTS: 2 REF: 061911aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

89 ANS: 3

$$(m - 2)^2(m + 3) = (m^2 - 4m + 4)(m + 3) = m^3 + 3m^2 - 4m^2 - 12m + 4m + 12 = m^3 - m^2 - 8m + 12$$

PTS: 2 REF: 081605aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

90 ANS: 1

$$1) \text{ let } y = x + 2, \text{ then } y^2 + 2y - 8$$

$$(y + 4)(y - 2)$$

$$(x + 2 + 4)(x + 2 - 2)$$

$$(x + 6)x$$

PTS: 2 REF: 081715aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: multivariable

91 ANS:

$$(x^2 - 6)(x^2 + 2)$$

PTS: 2 REF: 081825aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: higher power

92 ANS:

$$x^4 - 5x^2 + 4$$

$$(x^2 - 4)(x^2 - 1)$$

$$(x + 2)(x - 2)(x + 1)(x - 1)$$

PTS: 2 REF: 012331aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

93 ANS:

$$x^3 - 2x^2 - 9x + 18 = x^2(x - 2) - 9(x - 2) = (x^2 - 9)(x - 2) = (x + 3)(x - 3)(x - 2)$$

PTS: 2 REF: 082226aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

94 ANS:

$$x^3 + 4x^2 - 9x - 36 = x^2(x + 4) - 9(x + 4) = (x^2 - 9)(x + 4) = (x + 3)(x - 3)(x + 4)$$

PTS: 2 REF: 012425aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

95 ANS:

$$2x^3 - 3x^2 - 18x + 27$$

$$x^2(2x - 3) - 9(2x - 3)$$

$$(x^2 - 9)(2x - 3)$$

$$(x + 3)(x - 3)(2x - 3)$$

PTS: 2 REF: 082325aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

96 ANS:

$$x^2(4x - 1) + 4(4x - 1) = (x^2 + 4)(4x - 1)$$

PTS: 2 REF: 061727aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

97 ANS:

$$2x^4 - 10x^3 + 3x^2 - 15x = x(2x^3 - 10x^2 + 3x - 15) = x(2x^2(x - 5) + 3(x - 5)) = x(2x^2 + 3)(x - 5)$$

PTS: 2 REF: 082427aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

98 ANS:

$$-x(2x^3 - x^2 - 18x + 9)$$

$$-x(x^2(2x - 1) - 9(2x - 1))$$

$$-x(x^2 - 9)(2x - 1)$$

$$-x(x + 3)(x - 3)(2x - 1)$$

PTS: 2 REF: 062228aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

99 ANS:

$$3x^3 + x^2 + 3xy + y = x^2(3x + 1) + y(3x + 1) = (x^2 + y)(3x + 1)$$

PTS: 2 REF: 011828aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

100 ANS:

$$(x-1)^2 + 5(x-1) - 6$$

$$u^2 + 5u - 6$$

$$(u+6)(u-1)$$

$$(x-1+6)(x-1-1)$$

$$(x+5)(x-2)$$

PTS: 2 REF: 062527aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

101 ANS:

The expression is of the form $y^2 - 5y - 6$ or $(y-6)(y+1)$. Let $y = 4x^2 + 5x$:

$$(4x^2 + 5x - 6)(4x^2 + 5x + 1)$$

$$(4x-3)(x+2)(4x+1)(x+1)$$

PTS: 2 REF: fall1512aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: a>1

102 ANS: 1

$$x^3 + 2x^2 - 9x - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0$$

$$x^2(x+2) - 9(x+2) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0$$

$$(x+2)(x^2 - 9) = 0$$

PTS: 2 REF: 011903aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations

103 ANS: 4

$$m^3 - 2m^2 + 4m - 8 = 0$$

$$m^2(m-2) + 4(m-2) = 0$$

$$(m^2 + 4)(m-2) = 0$$

PTS: 2 REF: 081821aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations

104 ANS: 4

$$f(x) = (x+1)(x-1)(x-2) = (x^2 - 1)(x-2) = x^3 - 2x^2 - x + 2$$

PTS: 2 REF: 081921aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations

105 ANS: 4

1) -1 is also a zero. 2) $x^2(x-a) + 16(x-a) = (x^2 + 16)(x-a)$ a is the only zero. 3) $-a$ is the only zero. 4) $x^2(x-a) - 9(x-a) = (x^2 - 9)(x-a)$.

PTS: 2 REF: 012019aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations

106 ANS: 4

PTS: 2

REF: 081708aii

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

107 ANS: 3

$$3 \mid 1 \ 1 \ -3 \ 9 \ -108 \quad x^3 + 4x^2 + 9x + 36 = 0$$

$$\underline{\quad 3 \ 12 \ 27 \ 108} \quad x^2(x+4) + 9(x+4) = 0$$

$$1 \ 4 \ 9 \ 36 \quad 0 \quad (x^2 + 9)(x+4) = 0$$

$$x = \pm 3i, -4$$

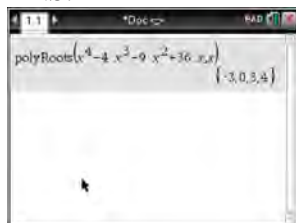
PTS: 2

REF: 062420aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

108 ANS: 1



$$x^4 - 4x^3 - 9x^2 + 36x = 0$$

$$x^3(x-4) - 9x(x-4) = 0$$

$$(x^3 - 9x)(x-4) = 0$$

$$x(x^2 - 9)(x-4) = 0$$

$$x(x+3)(x-3)(x-4) = 0$$

$$x = 0, \pm 3, 4$$

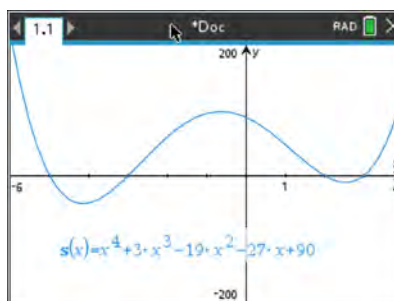
PTS: 2

REF: 061606aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

109 ANS: 4



$$s(x) = x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90$$

$$= x^2(x^2 - 9) + 3x(x^2 - 9) - 10(x^2 - 9)$$

$$= (x^2 + 3x - 10)(x^2 - 9)$$

$$= (x+5)(x-2)(x+3)(x-3)$$

PTS: 2

REF: 062303aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

110 ANS: 2

$$\begin{array}{cccccc} 3 & 1 & -1 & -21 & 45 & 0 \\ & & 3 & 6 & -45 & 0 \\ & & 1 & 2 & -15 & 0 & 0 \end{array}$$

$$x^3 + 2x^2 - 15x = 0$$

$$x(x^2 + 2x - 15) = 0$$

$$x(x+5)(x-3) = 0$$

$$x = 0, -5, 3$$

PTS: 2

REF: 012403aii

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

111 ANS:

$$3(x^3 + 4x^2 - x - 4) = 0$$

$$(x^2(x+4) - (x+4)) = 0$$

$$(x^2 - 1)(x+4) = 0$$

$$x = \pm 1, -4$$

PTS: 2

REF: 012325aii

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

112 ANS:

$$0 = 6(-5)^3 + b(-5)^2 - 52(-5) + 15 \quad z(x) = 6x^3 + 19x^2 - 52x + 15$$

$$0 = -750 + 25b + 260 + 15$$

$$475 = 25b$$

$$19 = b$$

$$\begin{array}{r|cccc} -5 & 6 & 19 & -52 & 15 \\ & & -30 & 55 & 15 \\ \hline & 6 & -11 & 3 & 0 \end{array}$$

$$6x^2 - 11x + 3 = 0$$

$$(2x-3)(3x-1) = 0$$

$$x = \frac{3}{2}, \frac{1}{3}, -5$$

PTS: 4

REF: fall1515aii

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

113 ANS: 1

The zeros of the polynomial are at $-b$, and c . The sketch of a polynomial of degree 3 with a negative leading coefficient should have end behavior showing as x goes to negative infinity, $f(x)$ goes to positive infinity. The multiplicities of the roots are correctly represented in the graph.

PTS: 2

REF: spr1501aii

NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

KEY: bimodalgraph

114 ANS: 1

PTS: 2

REF: 061701aii

NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

115 ANS: 4 PTS: 2 REF: 061921aai NAT: A.APR.B.3
TOP: Graphing Polynomial Functions

116 ANS: 2 PTS: 2 REF: 082324aai NAT: A.APR.B.3
TOP: Graphing Polynomial Functions

117 ANS: 1 PTS: 2 REF: 012405aai NAT: A.APR.B.3
TOP: Graphing Polynomial Functions

118 ANS: 2 PTS: 2 REF: 082513aai NAT: A.APR.B.3
TOP: Graphing Polynomial Functions

119 ANS: 1
 $x^2 + 2x + 1 = (x + 1)^2$

PTS: 2 REF: 011919aai NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

120 ANS:
 $f(x) = (x - 1)^2(x + 3)$

PTS: 2 REF: 062529aai NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

121 ANS: 3
The graph shows three real zeros, and has end behavior matching the given end behavior.

PTS: 2 REF: 061604aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions
KEY: bimodalgraph

122 ANS: 1 PTS: 2 REF: 082524aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

123 ANS: 2 PTS: 2 REF: 061816aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions KEY: bimodalgraph

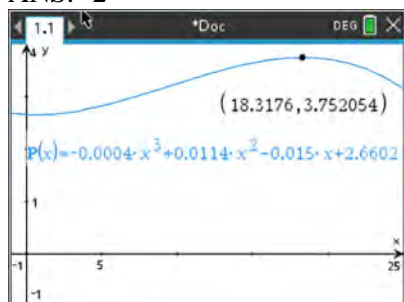
124 ANS: 1 PTS: 2 REF: 082414aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

125 ANS: 4 PTS: 2 REF: 082318aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

126 ANS: 3 PTS: 2 REF: 012005aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

127 ANS: 2 PTS: 2 REF: 061620aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

128 ANS: 2

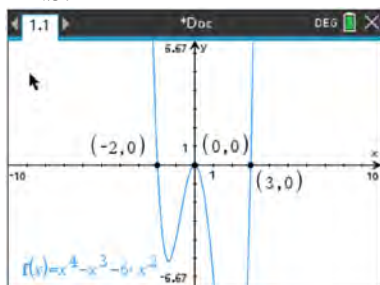


PTS: 2 REF: 012414aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

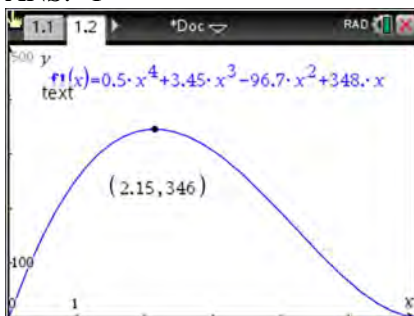
- 129 ANS: 2
1) $x \rightarrow \infty, f(x) \rightarrow \infty$; 3) quartic polynomial; 4) three real roots

PTS: 2 REF: 012318aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions
130 ANS: 2 PTS: 2 REF: 081908aai NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

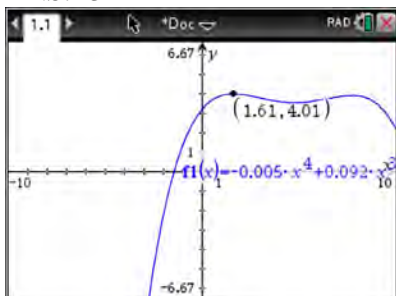
- 131 ANS: 2



PTS: 2 REF: 012316aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions
132 ANS: 1



PTS: 2 REF: 011908aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions
133 ANS: 3



PTS: 2 REF: 011817aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions
134 ANS: 4
The maximum volume of $p(x) = -(x+2)(x-10)(x-14)$ is about 56, at $x = 12.1$

PTS: 2 REF: 081712aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

135 ANS:

$$16x^4 - 81 = (4x^2 + 9)(4x^2 - 9) = (4x^2 + 9)(2x + 3)(2x - 3). \text{ No, because } \pm \frac{3i}{2} \text{ are roots.}$$

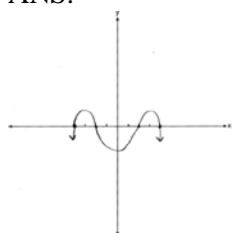
PTS: 4

REF: 061933aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

136 ANS:



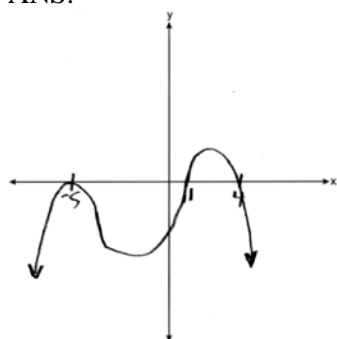
PTS: 2

REF: 011926aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

137 ANS:



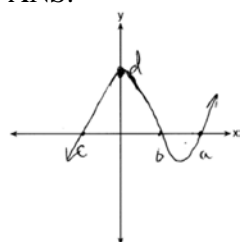
PTS: 2

REF: 062428aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

138 ANS:



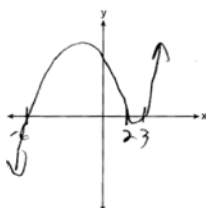
PTS: 2

REF: 081732aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

139 ANS:



$$p(x) = (x - 2)(x - 3)(x + 6)$$

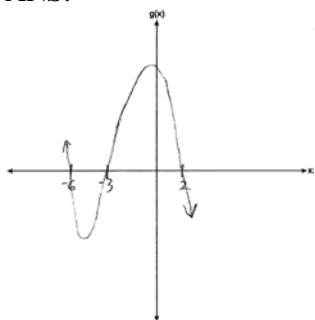
PTS: 4

REF: 062333aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

140 ANS:



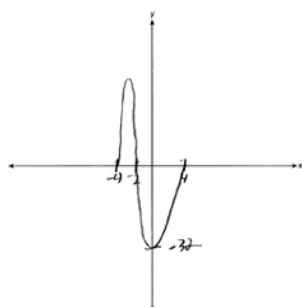
PTS: 2

REF: 082526aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

141 ANS:



$$x^3 + 2x^2 - 16x - 32 = 0$$

$$x^2(x + 2) - 16(x + 2) = 0$$

$$(x^2 - 16)(x + 2) = 0$$

$$(x + 4)(x - 4)(x + 2) = 0$$

$$x = -4, 4, -2$$

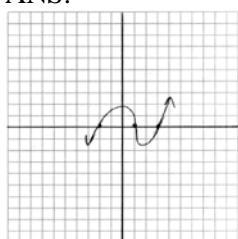
PTS: 4

REF: 012536aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

142 ANS:



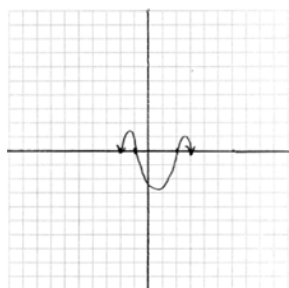
PTS: 2

REF: 011729aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

143 ANS:



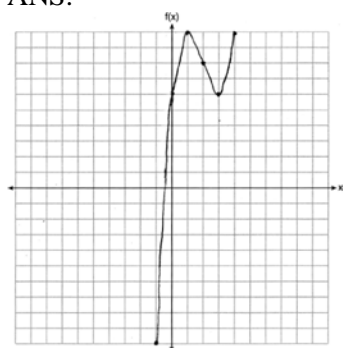
PTS: 2

REF: 011831aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

144 ANS:



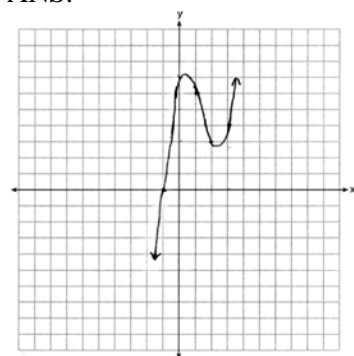
PTS: 2

REF: 061826aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

145 ANS:



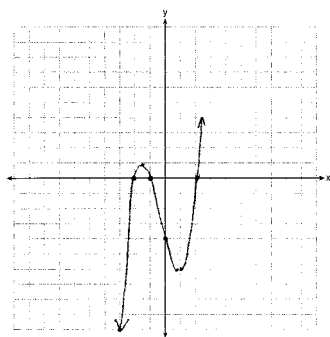
PTS: 2

REF: 012032aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

146 ANS:



$$0 = x^2(x + 1) - 4(x + 1)$$

$$0 = (x^2 - 4)(x + 1)$$

$$0 = (x + 2)(x - 2)(x + 1)$$

$$x = -2, -1, 2$$

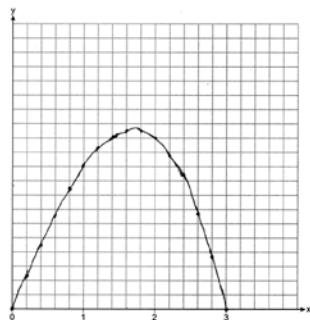
PTS: 4

REF: 081633aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

147 ANS:



12.6

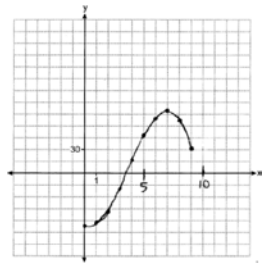
PTS: 4

REF: 082234aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

148 ANS:



(7, 38) If 7000 sweatshirts are sold, the profit is \$78,000. 3,549, because that is when $p(x)$ is first greater than 0.

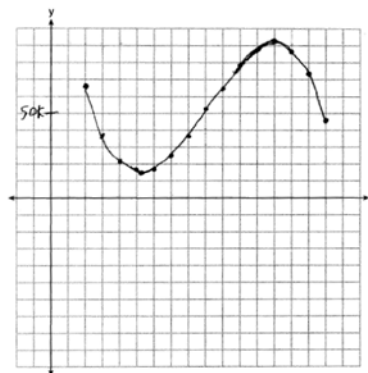
PTS: 6

REF: 012437aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

149 ANS:



$$P(x) = R(x) - C(x) = -330x^3 + 9000x^2 - 67000x + 167000$$

Least profitable at year 5 because there is a minimum in $P(x)$. Most profitable at year 13 because there is a maximum in $P(x)$.

PTS: 6 REF: 081837aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

150 ANS: 3

Since $x + 4$ is a factor of $p(x)$, there is no remainder.

PTS: 2 REF: 081621aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

151 ANS: 4

$$\begin{array}{r|rrrr} -2 & 1 & 6 & 1 & -14 \\ & & -2 & -8 & 14 \\ \hline & 1 & 4 & -7 & 0 \end{array}$$

Since there is no remainder when the cubic is divided by $g + 2$, this binomial is a factor.

PTS: 2 REF: 062512aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

152 ANS: 2

$$\begin{array}{r|rrrr} -4 & 1 & -11 & 16 & 84 \\ & & -4 & 60 & -304 \\ \hline & 1 & -15 & 76 & \end{array}$$

Since there is a remainder when the cubic is divided by $x + 4$, this binomial is not a factor.

PTS: 2 REF: 081720aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

153 ANS: 1

$$\begin{array}{r|rrrr} -2 & 1 & -1 & -11 & 5 & 30 \\ & & -2 & 6 & 10 & -30 \\ \hline & 1 & -3 & -5 & 15 & 0 \end{array}$$

Since there is no remainder when the quartic is divided by $x + 2$, this binomial is a factor.

PTS: 2 REF: 082320aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

154 ANS: 4

$$p(2) = 4(2)^3 - 3(2) + 3 = 29$$

PTS: 2 REF: 062422aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

155 ANS: 4

$$p(5) = 2(5)^3 - 3(5) + 5 = 240$$

PTS: 2 REF: 011819aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

156 ANS: 3

$$1^3 - k(1)^2 + 2(1) = 0$$

$$k = 3$$

PTS: 2 REF: 061812aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

157 ANS: 1

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & -4 & -4 & 8 \\ & & 2 & 4 & 0 & -8 \\ \hline & 1 & 2 & 0 & -4 & 0 \end{array}$$

Since there is no remainder when the quartic is divided by $x - 2$, this binomial is a factor.

PTS: 2 REF: 061711aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

158 ANS: 3

TOP: Remainder and Factor Theorems

PTS: 2

REF: 012508aia NAT: A.APR.B.2

159 ANS: 4

TOP: Remainder and Factor Theorems

PTS: 2

REF: 061907aia NAT: A.APR.B.2

160 ANS: 2

$$2x^3 + x^2 - 18x - 9$$

$$x^2(2x + 1) - 9(2x + 1)$$

$$(x^2 - 9)(2x + 1)$$

$$(x + 3)(x - 3)(2x + 1)$$

PTS: 2 REF: 082206aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

161 ANS: 2

TOP: Remainder and Factor Theorems

PTS: 2

REF: 062206aia NAT: A.APR.B.2

162 ANS: 2

TOP: Remainder and Factor Theorems

PTS: 2

REF: 011720aia NAT: A.APR.B.2

163 ANS: 2

$$2x^4 - x^3 - 16x + 8 = 0$$

$$x^3(2x - 1) - 8(2x - 1) = 0$$

$$(x^3 - 8)(2x - 1) = 0$$

$$x = 2, \frac{1}{2}$$

PTS: 2 REF: 012307aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

164 ANS: 3

$3 \mid -2 - 11 - 12 \quad 9 \quad x - 3$ is not a factor since there is a remainder. $-2 \mid -2 - 11 - 12 \quad 9$

$$\begin{array}{r} \underline{-6 \quad -51 \quad -189} \\ -2 \quad -17 \quad -63 \quad -180 \end{array}$$

$$\begin{array}{r} \underline{4 \quad 14 \quad -4} \\ -2 \quad -7 \quad 2 \quad 5 \end{array}$$

PTS: 2 REF: 062414aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

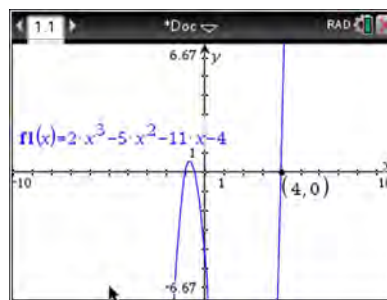
165 ANS:

$m(3) = 3^3 - 3^2 - 5(3) - 3 = 27 - 9 - 15 - 3 = 0$ Since $m(3) = 0$, there is no remainder when $m(x)$ is divided by $x - 3$, and so $x - 3$ is a factor.

PTS: 2 REF: 012026aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

166 ANS:

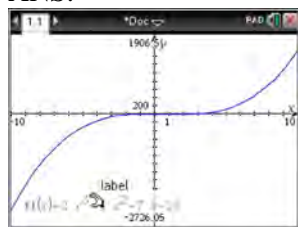
$f(4) = 2(4)^3 - 5(4)^2 - 11(4) - 4 = 128 - 80 - 44 - 4 = 0$ Any method that demonstrates 4 is a zero of $f(x)$ confirms



that $x - 4$ is a factor, as suggested by the Remainder Theorem.

PTS: 2 REF: spr1507aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

167 ANS:

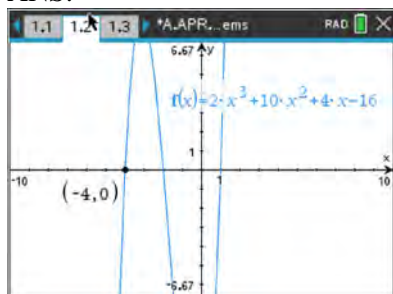


$$\begin{array}{r} 2x^2 + 6x + 23 \\ x - 5 \overline{) 2x^3 - 4x^2 - 7x - 10} \\ \underline{2x^3 - 10x^2} \\ 6x^2 - 7x \\ \underline{6x^2 - 30x} \\ 23x - 10 \\ \underline{23x - 115} \\ 105 \end{array}$$

Since there is a remainder, $x - 5$ is not a factor.

PTS: 2 REF: 061627aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

168 ANS:



Since -4 is a zero, $x + 4$ is a factor.

PTS: 2 REF: 012426aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

169 ANS:

Since there is no remainder when the cubic is divided by $x + 3$, this binomial is a factor.

$$\begin{array}{r|rrrr} -3 & 7 & 27 & 9 & -27 \\ & & -21 & -18 & 27 \\ \hline & 7 & 6 & -9 & 0 \end{array}$$

PTS: 2 REF: 082426aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

170 ANS:

$r(2) = -6$. Since there is a remainder when the cubic is divided by $x - 2$, this binomial is not a factor.

$$\begin{array}{r|rrrr} 2 & 1 & -4 & 4 & 6 \\ & & 2 & -4 & 0 \\ \hline & 1 & -2 & 0 & -6 \end{array}$$

PTS: 2 REF: 061725aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

171 ANS:

$P(-2) = 60$ $Q(-2) = 0$ $(x + 2)$ is a factor of $Q(x)$ since $Q(-2) = 0$.

PTS: 2 REF: 081929aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

172 ANS:

$$\begin{aligned} g(3) &= 0; & 0 &= 3^3 + a(3)^2 - 5(3) + 6 \\ & & 0 &= 27 + 9a - 15 + 6 \\ & & -18 &= 9a \\ & & a &= -2 \end{aligned}$$

PTS: 2 REF: 062328aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

173 ANS:

$$\begin{aligned} \text{Yes, } x^3 + 3x^2 - 2x - 6 & \quad (x^2 - 2)(x + 3) = 0 \\ x^2(x + 3) - 2(x + 3) & \quad x = \pm\sqrt{2}, -3 \\ (x^2 - 2)(x + 3) & \end{aligned}$$

PTS: 4 REF: 082534aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

174 ANS:

$$j(-1) = 2(-1)^4 - (-1)^3 - 35(-1)^2 + 16(-1) + 48 = 2 + 1 - 35 - 16 + 48 = 0; \quad x + 1 \text{ is a factor of } j(x);$$

$$2x^3 - 3x^2 - 32x + 48 = 0$$

$$x^2(2x - 3) - 16(2x - 3) = 0$$

$$(x^2 - 16)(2x - 3) = 0$$

$$x = \pm 4, \frac{3}{2}$$

PTS: 4 REF: 081834aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

175 ANS:

The denominator of the rational exponent represents the index of a root, and the 4th root of 81 is 3 and 3^3 is 27.

PTS: 2 REF: 011832aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

176 ANS:

Rewrite $\frac{4}{3}$ as $\frac{1}{3} \cdot \frac{4}{1}$, using the power of a power rule.

PTS: 2 REF: 081725aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

177 ANS:

Applying the commutative property, $\left(3^{\frac{1}{5}}\right)^2$ can be rewritten as $\left(3^2\right)^{\frac{1}{5}}$ or $9^{\frac{1}{5}}$. A fractional exponent can be

rewritten as a radical with the denominator as the index, or $9^{\frac{1}{5}} = \sqrt[5]{9}$.

PTS: 2 REF: 081626aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

178 ANS:

The denominator of the rational exponent represents the index of a root, and the numerator of the rational exponent represents the power of the base. $\left(\sqrt{9}\right)^5 = 243$

PTS: 2 REF: 081926aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

179 ANS: 1

PTS: 2

REF: 062201aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

180 ANS: 3

$$\sqrt[3]{16x^6} = \sqrt[3]{8^3 \sqrt[3]{x^6} \sqrt[3]{2}} = 2x^2 \sqrt[3]{2}$$

PTS: 2 REF: 082504aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

181 ANS: 1

$$8^{\frac{x}{2}} \bullet 8^{\frac{x}{3}} = 8^{\frac{5x}{6}} = \sqrt[6]{8^{5x}}$$

PTS: 2 REF: 082419aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

182 ANS: 1

$$2c\sqrt[3]{c} = 2c^{\frac{3}{3}} \cdot c^{\frac{1}{3}} = 2c^{\frac{4}{3}}$$

PTS: 2 REF: 062501aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

183 ANS: 2

$$a^5\sqrt[5]{a^4} = a^{\frac{5}{5}} \cdot a^{\frac{4}{5}} = a^{\frac{9}{5}}$$

PTS: 2 REF: 062306aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

184 ANS: 1

$$2xy^2\sqrt[3]{x^2y} = 2x^{\frac{3}{3}}y^{\frac{6}{3}}x^{\frac{2}{3}}y^{\frac{1}{3}} = 2x^{\frac{5}{3}}y^{\frac{7}{3}}$$

PTS: 2 REF: 062413aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

185 ANS: 1

$$\sqrt[4]{81x^8y^6} = 81^{\frac{1}{4}}x^{\frac{8}{4}}y^{\frac{6}{4}} = 3x^2y^{\frac{3}{2}}$$

PTS: 2 REF: 012001aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

186 ANS: 3

$$\sqrt{x} \cdot \sqrt[4]{x^{11}} = x^{\frac{1}{2}} \cdot x^{\frac{11}{4}} = x^{\frac{2}{4}} \cdot x^{\frac{11}{4}} = x^{\frac{13}{4}}$$

PTS: 2 REF: 012511aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

187 ANS: 4

$$\sqrt[3]{9x^2} \cdot \sqrt{9x} = 9^{\frac{1}{3}} \cdot x^{\frac{2}{3}} \cdot 9^{\frac{1}{2}} \cdot x^{\frac{1}{2}} = 9^{\frac{5}{6}}x^{\frac{7}{6}}$$

PTS: 2 REF: 082521aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

188 ANS: 3

$$\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}} = x^{\frac{1}{5} - \frac{1}{2}} = x^{-\frac{3}{10}} = \frac{1}{x^{\frac{3}{10}}} = \frac{1}{\sqrt[10]{x^3}}$$

PTS: 2 REF: 012312aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

189 ANS: 4

$$\frac{n}{m} = \frac{\sqrt{a^5}}{a^{\frac{2}{2}}} = \frac{a^{\frac{5}{2}}}{a^{\frac{2}{2}}} = a^{\frac{3}{2}} = \sqrt{a^3}$$

PTS: 2 REF: 011811aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

190 ANS: 2

$$\left(\frac{1}{x^{-2}}\right)^{-\frac{3}{4}} = \frac{1}{x^{\frac{3}{2}}} = \frac{1}{x^{\frac{2}{2}} \cdot x^{\frac{1}{2}}} = \frac{1}{x\sqrt{x}}$$

PTS: 2 REF: 082412aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

191 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

PTS: 2 REF: 011707aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

192 ANS: 4 PTS: 2 REF: 061601aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents KEY: variables

193 ANS: 3

$$P = 210x^{\frac{4}{3}}y^{\frac{7}{3}} = 210x^{\frac{3}{3}}x^{\frac{1}{3}}y^{\frac{6}{3}}y^{\frac{1}{3}} = 210x \cdot x^{\frac{1}{3}}y^2y^{\frac{1}{3}} = 210xy^2\sqrt[3]{xy}$$

PTS: 2 REF: 012413aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

194 ANS: 4

$$\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}} = \frac{(2 \cdot -27)^{\frac{2}{3}}x^{\frac{18}{3}}}{y^{\frac{8}{3}}} = \frac{2^{\frac{2}{3}} \cdot 9x^6}{y^2 \cdot y^{\frac{2}{3}}} = \frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$$

PTS: 2 REF: 081723aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

195 ANS: 3

$$\frac{x^{\frac{2}{3}} \bullet x^{\frac{5}{2}}}{x^{\frac{1}{6}}} = \frac{x^{\frac{4}{6}} \bullet x^{\frac{15}{6}}}{x^{\frac{1}{6}}} = x^{\frac{18}{6}} = x^3$$

PTS: 2 REF: 081812aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

196 ANS: 4 PTS: 2 REF: 061716aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents KEY: variables

197 ANS: 4

$$\text{I. } \left(\frac{y}{x^3}\right)^{-1} = \frac{x^3}{y}; \text{ II. } \sqrt[3]{x^9}(y^{-1}) = \frac{x^{\frac{9}{3}}}{y} = \frac{x^3}{y}; \text{ III. } \frac{x^{64}\sqrt{y^8}}{x^3y^3} = \frac{x^3y^{\frac{8}{4}}}{y^3} = \frac{x^3}{y}$$

PTS: 2 REF: 062320aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

198 ANS: 1

$$(x^{\frac{3}{2}})^2 = x^3$$

PTS: 2

REF: 061908aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

199 ANS: 1

$$\left(a^3\sqrt{2b^2}\right)\left(\sqrt[3]{4a^2b}\right) = a^3\sqrt{8a^2b^3} = 2ab^3\sqrt{a^2}$$

PTS: 2

REF: 082213aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

200 ANS: 4

$$\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2} = 3^{\frac{1}{2}}x^{\frac{1}{2}}y^{\frac{1}{2}} \cdot 3^{\frac{2}{3}}x^{\frac{2}{3}}y^{\frac{2}{3}} = 3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$$

PTS: 2

REF: 081914aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

201 ANS: 2

$$4x \cdot x^{\frac{2}{3}} + 2x^{\frac{5}{3}} = 4x^{\frac{5}{3}} + 2x^{\frac{5}{3}} = 6x^{\frac{5}{3}} = 6\sqrt[3]{x^5}$$

PTS: 2

REF: 061820aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

202 ANS:

$$\sqrt[3]{x} \cdot \sqrt{x} = x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{2}{6}} \cdot x^{\frac{3}{6}} = x^{\frac{5}{6}}$$

PTS: 2

REF: 061731aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

203 ANS:

$$\text{No. } \left(\sqrt[7]{x^2}\right)\left(\sqrt[5]{x^3}\right) = x^{\frac{2}{7}} \cdot x^{\frac{3}{5}} = x^{\frac{31}{35}} = \sqrt[35]{x^{31}}$$

PTS: 2

REF: 061929aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

204 ANS:

$$\left(p^2n^{\frac{1}{2}}\right)^8 \sqrt{p^5n^4} = \left(p^{16}n^4\right)p^2n^2\sqrt{p} = p^{18}n^6\sqrt{p}$$

PTS: 2

REF: 012025aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

205 ANS:

$$\left(\frac{1}{\sqrt[3]{y^2}}\right)^4 = \frac{y^{\frac{12}{3}}}{y^{\frac{10}{3}}} = y^{\frac{10}{3}} \quad n = \frac{10}{3}$$

PTS: 2

REF: 012428aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

206 ANS:

$$\frac{x \cdot x^{\frac{3}{2}}}{x^{\frac{5}{3}}} = \frac{x^{\frac{6}{6}} \cdot x^{\frac{9}{6}}}{x^{\frac{10}{6}}} = x^{\frac{5}{6}}$$

PTS: 2

REF: 082331aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

207 ANS:

$$\frac{x^{\frac{8}{3}}}{x^{\frac{4}{3}}} = x^y$$

$$x^{\frac{4}{3}} = x^y$$

$$\frac{4}{3} = y$$

PTS: 2

REF: spr1505aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: numbers

208 ANS:

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = \frac{a^{\frac{10}{5}}}{a^{\frac{3}{2}}} = \frac{a^{\frac{20}{10}}}{a^{\frac{15}{10}}} = a^{\frac{5}{10}} \quad x = \frac{1}{2}$$

PTS: 2

REF: 012528aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

209 ANS:

$$\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}} = \frac{x^{\frac{2}{3}} y^{\frac{5}{3}}}{x^{\frac{3}{4}} y^{\frac{12}{12}}} = \frac{x^{\frac{8}{12}} y^{\frac{20}{12}}}{x^{\frac{9}{12}} y^{\frac{12}{12}}} = x^{-\frac{1}{12}} y^{\frac{2}{3}}$$

PTS: 2

REF: 011925aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

210 ANS:

$$\frac{2x^{\frac{3}{2}}}{2x^{\frac{2}{2}}} = x^{\frac{1}{2}} = \sqrt{x}$$

PTS: 2

REF: 081826aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

211 ANS:

$$\sqrt[3]{81} = \sqrt[3]{3^4} = 3^{\frac{4}{3}} \quad a = \frac{4}{3}$$

PTS: 2 REF: 062230aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

212 ANS:

$$\left(\frac{y^{\frac{17}{8}}}{y^{\frac{10}{8}}} \right)^{-4} = y^n \quad n = -\frac{7}{2}$$

$$\left(y^{\frac{7}{8}} \right)^{-4} = y^n$$

$$y^{-\frac{7}{2}} = y^n$$

PTS: 2 REF: 082228aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

213 ANS:

$$\left(x^{\frac{5}{3}} \right)^{\frac{6}{5}} = \left(y^{\frac{5}{6}} \right)^{\frac{6}{5}}$$

$$x^2 = y$$

PTS: 2 REF: 011730aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

214 ANS: 3

$$\sqrt{56-x} = x \quad -8 \text{ is extraneous.}$$

$$56-x = x^2$$

$$0 = x^2 + x - 56$$

$$0 = (x+8)(x-7)$$

$$x = 7$$

PTS: 2 REF: 061605aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

Algebra II Regents Exam Questions by State Standard: Topic Answer Section

215 ANS: 2

$$x^2 = 3x + 40. \quad x = -5 \text{ is an extraneous solution.}$$

$$x^2 - 3x - 40 = 0$$

$$(x - 8)(x + 5) = 0$$

$$x = 8, -5$$

PTS: 2

REF: 012010aaii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

216 ANS: 3

$$\sqrt{3x + 18} = x \quad -3 \text{ is extraneous.}$$

$$3x + 18 = x^2$$

$$x^2 - 3x - 18 = 0$$

$$(x - 6)(x + 3) = 0$$

$$x = 6, -3$$

PTS: 2

REF: 082315aaii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

217 ANS: 3

$$\sqrt{x + 1} = x + 1$$

$$x + 1 = x^2 + 2x + 1$$

$$0 = x^2 + x$$

$$0 = x(x + 1)$$

$$x = -1, 0$$

PTS: 2

REF: 011802aaii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

218 ANS: 2

$$(x - 1)^2 = 2x + 6 \quad -1 \text{ is extraneous.}$$

$$x^2 - 2x + 1 = 2x + 6$$

$$x^2 - 4x - 5 = 0$$

$$(x - 5)(x + 1) = 0$$

$$x = 5, -1$$

PTS: 2

REF: 082411aaii

NAT: A.REI.A.2

TOP: Solving Radicals

219 ANS: 2

$$x + 1 = \sqrt{4x + 25} \quad -4 + 1 < 0$$

$$x^2 + 2x + 1 = 4x + 25$$

$$x^2 - 2x - 24 = 0$$

$$(x - 6)(x + 4) = 0$$

$$x = 6, -4$$

PTS: 2

REF: 062408aai

NAT: A.REI.A.2

TOP: Solving Radicals

220 ANS: 2

$$b^2 = 2b^2 - 64 \quad -8 \text{ is extraneous.}$$

$$-b^2 = -64$$

$$b = \pm 8$$

PTS: 2

REF: 061919aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

221 ANS: 3

$$x^2 - 4x - 5 = 4x^2 - 40x + 100$$

$$3x^2 - 36x + 105 = 0$$

$$x^2 - 12x + 35 = 0$$

$$(x - 7)(x - 5) = 0$$

$$x = 5, 7$$

PTS: 2

REF: 081807aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

222 ANS: 2

$$\sqrt{x + 14} = \sqrt{2x + 5} + 1$$

$$\sqrt{22 + 14} - \sqrt{2(22) + 5} = 1$$

$$x + 14 = 2x + 5 + 2\sqrt{2x + 5} + 1$$

$$6 - 7 \neq 1$$

$$-x + 8 = 2\sqrt{2x + 5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x - 22)(x - 2) = 0$$

$$x = 2, 22$$

PTS: 2

REF: 081704aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: advanced

223 ANS: 2

$$\sqrt{4-x} = x+8 \quad -12+8 = -4$$

$$4-x = x^2 + 16x + 64$$

$$0 = x^2 + 17x + 60$$

$$x = (x+12)(x-5)$$

$$x = -12, 5$$

PTS: 2

REF: 012521aaii

NAT: A.REI.A.2

TOP: Solving Radicals

224 ANS:

$$3x+7 = x^2 - 2x+1 \quad -1 \text{ is extraneous.}$$

$$0 = x^2 - 5x - 6$$

$$0 = (x-6)(x+1)$$

$$x = 6, -1$$

PTS: 2

REF: 062326aaii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

225 ANS:

$$\sqrt{4x+1} = 11-x \quad 20 \text{ is extraneous.}$$

$$4x+1 = 121 - 22x + x^2$$

$$0 = x^2 - 26x + 120$$

$$0 = (x-6)(x-20)$$

$$x = 6, 20$$

PTS: 2

REF: 082227aaii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

226 ANS:

$$\sqrt{x-2} = 4-x \quad 6 \text{ is extraneous.}$$

$$x-2 = 16 - 8x + x^2$$

$$0 = x^2 - 9x + 18$$

$$0 = (x-6)(x-3)$$

$$x = 6, 3$$

PTS: 2

REF: 062526aaii

NAT: A.REI.A.2

TOP: Solving Radicals

227 ANS:

$$\sqrt{x-4} = -x+6 \quad \sqrt{x-4} = -8+6 = -2 \text{ is extraneous.}$$

$$x-4 = x^2 - 12x + 36$$

$$0 = x^2 - 13x + 40$$

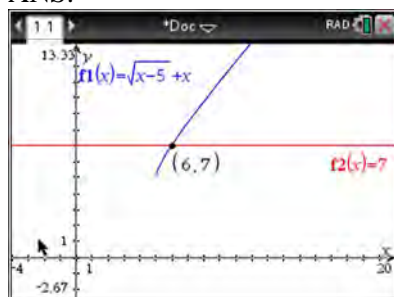
$$0 = (x-8)(x-5)$$

$$x = 5, 8$$

PTS: 2 REF: 061730aia NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

228 ANS:



$$\sqrt{x-5} = -x+7 \quad \sqrt{x-5} = -9+7 = -2 \text{ is extraneous.}$$

$$x-5 = x^2 - 14x + 49$$

$$0 = x^2 - 15x + 54$$

$$0 = (x-6)(x-9)$$

$$x = 6, 9$$

PTS: 2 REF: spr1508aia NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

229 ANS:

$$\sqrt{x+5} = x+3 \quad -4 \text{ is extraneous.}$$

$$x+5 = x^2 + 6x + 9$$

$$0 = x^2 + 5x + 4$$

$$0 = (x+4)(x+1)$$

$$x = -4, -1$$

PTS: 2 REF: 082530aia NAT: A.REI.A.2 TOP: Solving Radicals

230 ANS:

$$\sqrt{49-10x} = 2x-5 \quad -\frac{3}{2} \text{ is extraneous.}$$

$$49-10x = 4x^2 - 20x + 25$$

$$0 = 4x^2 - 10x - 24$$

$$0 = 2x^2 - 5x - 12$$

$$0 = (2x+3)(x-4)$$

$$x = -\frac{3}{2}, 4$$

PTS: 4 REF: 012333aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

231 ANS:

$$\sqrt{6-2x} + x = 2x + 30 - 9 \quad \sqrt{6-2(-29)} \neq -29 + 21, \text{ so } -29 \text{ is extraneous.}$$

$$\sqrt{6-2x} = x + 21 \quad \sqrt{64} \neq -8$$

$$6-2x = x^2 + 42x + 441$$

$$x^2 + 44x + 435 = 0$$

$$(x+29)(x+15) = 0$$

$$x = -29, -15$$

PTS: 4 REF: 061833aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

232 ANS:

$$2x-6 = 2\sqrt{x-1} \quad 2 \text{ is extraneous.}$$

$$4x^2 - 24x + 36 = 4(x-1)$$

$$x^2 - 6x + 9 = x - 1$$

$$x^2 - 7x + 10 = 0$$

$$(x-5)(x-2) = 0$$

$$x = 2, 5$$

PTS: 4 REF: 012434aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

233 ANS:

$$3\sqrt{x} - 2x = -5 \quad 1 \text{ is extraneous.}$$

$$3\sqrt{x} = 2x - 5$$

$$9x = 4x^2 - 20x + 25$$

$$4x^2 - 29x + 25 = 0$$

$$(4x - 25)(x - 1) = 0$$

$$x = \frac{25}{4}, 1$$

PTS: 4 REF: 011936aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

234 ANS:

$$\left(\sqrt{2x-7}\right)^2 = (5-x)^2 \quad \sqrt{2(4)-7} + 4 = 5 \quad \sqrt{2(8)-7} + 8 = 5$$

$$2x - 7 = 25 - 10x + x^2 \quad \sqrt{1} = 1 \quad \sqrt{9} \neq -3$$

$$0 = x^2 - 12x + 32$$

$$0 = (x-8)(x-4)$$

$$x = 4, 8$$

PTS: 4 REF: 081635aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

235 ANS:

$$0 = \sqrt{t} - 2t + 6 \quad 2\left(\frac{9}{4}\right) - 6 < 0, \text{ so } \frac{9}{4} \text{ is extraneous.}$$

$$2t - 6 = \sqrt{t}$$

$$4t^2 - 24t + 36 = t$$

$$4t^2 - 25t + 36 = 0$$

$$(4t-9)(t-4) = 0$$

$$t = \frac{9}{4}, 4$$

$$(\sqrt{1} - 2(1) + 6) - (\sqrt{3} - 2(3) + 6) = 5 - \sqrt{3} \approx 3.268 \text{ 327 mph}$$

PTS: 6 REF: 011737aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

236 ANS:

$$t = 2\pi\sqrt{\frac{67}{9.81}} \approx 16.4 \quad 9.6 = 2\pi\sqrt{\frac{L}{9.81}}$$

$$L \approx 22.9$$

PTS: 4 REF: 062234aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

237 ANS:

$$B = 1.69\sqrt{30 + 4.45} - 3.49 \approx 6, \text{ which is a steady breeze.}$$

$$15 = 1.69\sqrt{s + 4.45} - 3.49$$

$$18.49 = 1.69\sqrt{s + 4.45}$$

$$\frac{18.49}{1.69} = \sqrt{s + 4.45}$$

$$\left(\frac{18.49}{1.69}\right)^2 = s + 4.45$$

$$s = \left(\frac{18.49}{1.69}\right)^2 - 4.45$$

$$s \approx 115$$

$$9.5 = 1.69\sqrt{s + 4.45} - 3.49$$

$$10.49 = 1.69\sqrt{s + 4.45} - 3.49 \quad 55-64$$

$$12.99 = 1.69\sqrt{s + 4.45}$$

$$13.98 = 1.69\sqrt{s + 4.45}$$

$$\frac{12.99}{1.69} = \sqrt{s + 4.45}$$

$$\frac{13.98}{1.69} = \sqrt{s + 4.45}$$

$$\left(\frac{12.99}{1.69}\right)^2 = s + 4.45$$

$$\left(\frac{13.98}{1.69}\right)^2 = s + 4.45$$

$$s = \left(\frac{12.99}{1.69}\right)^2 - 4.45$$

$$s = \left(\frac{13.98}{1.69}\right)^2 - 4.45$$

$$s \approx 55$$

$$s \approx 64$$

PTS: 6 REF: 081937aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

238 ANS: 1

$$1 + \frac{0.027}{12} = 1.00225$$

PTS: 2 REF: 082403aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

239 ANS: 2

$$1.00643^{12} \approx 1.08$$

PTS: 2 REF: 081808aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

240 ANS: 2

$B(t) = 750 \left(1.16^{\frac{1}{12}} \right)^{12t} \approx 750(1.012)^{12t}$
 $B(t) = 750 \left(1 + \frac{0.16}{12} \right)^{12t}$ is wrong, because the growth is an annual rate that is not compounded monthly.

PTS: 2 REF: spr1504aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

241 ANS: 1

$$50(1.19^{\frac{1}{12}})^{12t} \approx 50(1.015)^{12t}$$

PTS: 2 REF: 012424aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

242 ANS: 1

$$1.025^{\frac{1}{12}} \approx 1.00206$$

PTS: 2 REF: 081924aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

243 ANS: 1

$$\left(1.03^{\frac{1}{12}} \right)^{12t} \approx 1.00247^{12t}$$

PTS: 2 REF: 062224aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

244 ANS: 3

$$1.04^{\frac{1}{12}} \approx 1.0032737$$

PTS: 2 REF: 011906aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

245 ANS: 1

$$1.0325^{\frac{1}{12}} \approx 1.0027$$

PTS: 2 REF: 012323aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

246 ANS: 3

$$1.0525^{\frac{1}{12}} \approx 1.00427$$

PTS: 2 REF: 061621aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

247 ANS: 4

$$1.06^{\frac{1}{52}}$$

PTS: 2 REF: 061924aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

248 ANS: 2

$$N(t) = 2(1.0098^{\frac{1}{60}})^{60t} \approx 2(1.000163)^{60t}$$

PTS: 2 REF: 082522aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

249 ANS: 3

$$0.75^{\frac{1}{10}} \approx .9716$$

PTS: 2 REF: 061713aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

250 ANS: 2

$$.962^{10} \approx .679$$

PTS: 2 REF: 082311aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

251 ANS: 4

$$1 \text{ year} = 365 \text{ days}$$

PTS: 2 REF: 061823aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

252 ANS: 4

$$A(t) = 150\left((1.02)^{\frac{1}{7}}\right)^{7t} \approx 150(1.00283)^{7t}$$

PTS: 2 REF: 062415aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

253 ANS: 3

$$\left((1.026)^5\right)^{\frac{t}{5}} \approx 1.136938^{\frac{t}{5}}$$

PTS: 2 REF: 062520aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

254 ANS: 1

$$0.5^{\frac{1}{0.0803}} \approx 0.000178$$

PTS: 2 REF: 082224aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

255 ANS: 3

$$\left(\frac{1}{2}\right)^{\frac{1}{73.83}} \approx 0.990656$$

PTS: 2 REF: 081710aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

256 ANS: 3

$$e^{\left(\frac{-3}{0.6}\right)} \approx 0.006738$$

PTS: 2 REF: 062315aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

257 ANS: 4

$$1 + \frac{.009}{12} = 1.00075$$

PTS: 2 REF: 011918aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

258 ANS: 4 PTS: 2 REF: 011808aai NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

259 ANS:

$$\text{Julia: } V(x) = 33,400(0.85^{\frac{1}{12}})^{12x} \approx 33,400(0.9865)^{12x}$$

PTS: 2 REF: 012530aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

260 ANS: 1 PTS: 2 REF: 082309aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

261 ANS: 4 PTS: 2 REF: 062411aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

262 ANS: 1

$$2000 \left(1 + \frac{.032}{12} \right)^{12t} \approx 2000(1.003)^{12t}$$

PTS: 2 REF: 012004aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

263 ANS: 4 PTS: 2 REF: 081622aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

264 ANS: 1

$$\frac{A}{P} = e^{rt}$$

$$0.42 = e^{rt}$$

$$\ln 0.42 = \ln e^{rt}$$

$$-0.87 \approx rt$$

PTS: 2 REF: 011723aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

265 ANS: 3
 $a = 105, 0 < b < 1$

PTS: 2 REF: 082314aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

266 ANS:

$$B(t) = 100(2)^{\frac{t}{30}}$$

PTS: 2 REF: 012031aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

267 ANS:

$$C(t) = 130(0.5)^{\frac{t}{5.5}}$$

PTS: 2 REF: 082430aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

268 ANS: 3

$$y = 278(0.5)^{\frac{18}{1.8}} \approx 0.271$$

PTS: 2 REF: 011920aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

269 ANS: 1

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2 REF: 011702aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

270 ANS: 4

$$5000 \left(1 + \frac{.035}{12} \right)^{12 \cdot 6} \approx 6166.50$$

PTS: 2 REF: 081917aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

271 ANS:

$$N(t) = 950e^{0.0475t} \text{ The base is } e \text{ because growth is continuous. } N\left(\frac{36}{24}\right) \approx 1020$$

PTS: 4 REF: 081933aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

272 ANS:

$A(t) = 100(0.5)^{\frac{t}{63}}$, where t is time in years, and $A(t)$ is the amount of titanium-44 left after t years.

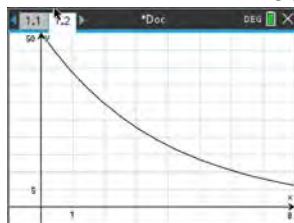
$$\frac{A(10) - A(0)}{10 - 0} = \frac{89.58132 - 100}{10} = -1.041868 \text{ The estimated mass at } t = 40 \text{ is } 100 - 40(-1.041868) \approx 58.3. \text{ The}$$

actual mass is $A(40) = 100(0.5)^{\frac{40}{63}} \approx 64.3976$. The estimated mass is less than the actual mass.

PTS: 6 REF: fall1517aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

273 ANS: 1

Estimate (0,50) and (1,38) as points on the graph. $\frac{38}{50} = 76\%$ implies an estimated 24% rate of decay. Confirmed



with graph of $y = 50(.77)^x$:

PTS: 2 REF: 012516aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

274 ANS: 4 PTS: 2 REF: 012303aai NAT: F.LE.B.5

TOP: Modeling Exponential Functions

275 ANS: 2

$$1 - .965 = .035 = 3.5\%$$

PTS: 2 REF: 062504aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

276 ANS: 4 PTS: 2 REF: 011805aai NAT: F.LE.B.5
TOP: Modeling Exponential Functions

277 ANS: 1
1) $A(20) > 0$; 2) $.5 \times .5 = .25$; 3) true; 4) $A(7) \approx 9.9$

PTS: 2 REF: 082211aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions
278 ANS: 1
The car lost approximately 19% of its value each year.

PTS: 2 REF: 081613aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions
279 ANS: 2
The mass of the carbon-14 is decreasing by half every 5715 years.

PTS: 2 REF: 062211aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions
280 ANS: 2
The 2010 population is 110 million.

PTS: 2 REF: 061718aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions
281 ANS: 1

II. The mass of the substance doubles every 20 years; III. $E(3 \cdot 60) = 26(2)^{\frac{180}{20}} \approx 13312$

PTS: 2 REF: 082520aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions
282 ANS: 2 PTS: 2 REF: 061917aai NAT: F.LE.B.5
TOP: Modeling Exponential Functions

283 ANS: 2
$$i = \frac{6.24\%}{12} = .52\% \quad R = \frac{(18000)(.52\%)}{1 - (1 + .52\%)^{-12 \cdot 6}} \approx 300.36$$

PTS: 2 REF: 012420aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions
284 ANS: 4

$$M = \frac{45000 \left(\frac{6.75\%}{12} \right) \left(1 + \frac{6.75\%}{12} \right)^{5 \times 12}}{\left(1 + \frac{6.75\%}{12} \right)^{5 \times 12} - 1} \approx 885.76$$

PTS: 2 REF: 082316aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions
285 ANS: 3

$$M = \frac{240000 \left(\frac{4.5\%}{12} \right) \left(1 + \frac{4.5\%}{12} \right)^{15 \times 12}}{\left(1 + \frac{4.5\%}{12} \right)^{15 \times 12} - 1} \approx 1835.98$$

PTS: 2 REF: 062209aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

286 ANS:

$$M = \frac{(152500 - 15250) \left(\frac{.036}{12} \right) \left(1 + \frac{.036}{12} \right)^{360}}{\left(1 + \frac{.036}{12} \right)^{360} - 1} \approx 624$$

PTS: 2 REF: 061831aii NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

287 ANS:

$$20000 = PMT \left(\frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right) \quad 21000 - x = 300 \left(\frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right)$$

$$PMT \approx 400.76$$

$$x \approx 6028$$

PTS: 4 REF: 011736aii NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

288 ANS:

$$M = 172600 \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1} \approx 1247 \quad 1100 = (172600 - x) \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1}$$

$$1100 \approx (172600 - x) \cdot (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

PTS: 4 REF: 061734aii NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

289 ANS: 4

$$F = 325 - 185e^{-0.4(0)} = 325 - 185 = 140$$

PTS: 2 REF: 012415aii NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

290 ANS: 3

$$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

PTS: 2 REF: 011715aii NAT: F.IF.B.4 TOP: Evaluating Logarithmic Expressions

291 ANS: 4

There is no x -intercept.

PTS: 2 REF: 011823aii NAT: F.IF.C.7 TOP: Graphing Exponential Functions

292 ANS: 2

$$2^x - 4 > 0$$

$$2^x > 4$$

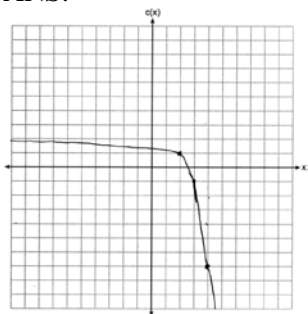
$$x > 2$$

PTS: 2 REF: 082402aii NAT: F.IF.C.7 TOP: Graphing Exponential Functions

293 ANS: 3 PTS: 2 REF: 082214aia NAT: F.IF.C.7
 TOP: Graphing Exponential Functions

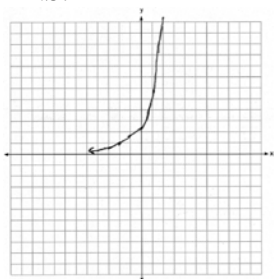
294 ANS:
 Translation 3 units right and 4 units up

PTS: 2 REF: 012027aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions
 295 ANS:

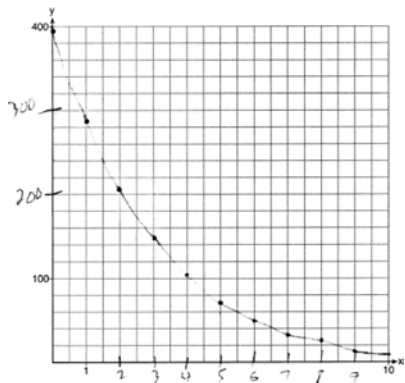


As $x \rightarrow \infty, c(x) \rightarrow -\infty$. As $x \rightarrow -\infty, c(x) \rightarrow 2$.

PTS: 4 REF: 012335aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions
 296 ANS:

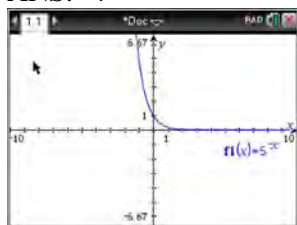


PTS: 2 REF: 082425aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions
 297 ANS:



PTS: 2 REF: 061729aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions

298 ANS: 4



$$y = 5^{-t} = \left(\frac{1}{5}\right)^t$$

PTS: 2 REF: 061615aia NAT: F.IF.C.8 TOP: Graphing Exponential Functions

299 ANS: 2

$$p(x) = 4^x, q(x) = \left(\frac{5}{9}\right)^x, r(x) = 5.29^x, s(x) = 2^x$$

PTS: 2 REF: 012304aia NAT: F.IF.C.8 TOP: Graphing Exponential Functions

300 ANS: 2 PTS: 2 REF: 061802aia NAT: F.IF.C.8

TOP: Graphing Exponential Functions

301 ANS:

 $e^{0.0532} > 1$, so $P(t)$ is increasing.

PTS: 2 REF: 062327aia NAT: F.IF.C.8 TOP: Graphing Exponential Functions

302 ANS:

 $0 < e^{\frac{\ln \frac{1}{2}}{1590}} < 1$, so $M(t)$ represents decay.

PTS: 2 REF: 011728aia NAT: F.IF.C.8 TOP: Graphing Exponential Functions

303 ANS: 3 PTS: 2 REF: 011917aia NAT: F.BF.B.5

TOP: Inverse of Functions KEY: exponential

304 ANS: 3 PTS: 2 REF: 011708aia NAT: F.BF.B.5

TOP: Inverse of Functions KEY: exponential

305 ANS: 2 PTS: 2 REF: 081816aia NAT: F.BF.B.5

TOP: Inverse of Functions KEY: exponential

306 ANS:

No, because $f(-x) = 2^{-x}$ $g(x) = f(x) + 5$ $y = 2^x + 5$

$$2^{-x} \neq 2^x \qquad x = 2^y + 5$$

$$\log(x - 5) = \log 2^y$$

$$\frac{\log(x - 5)}{\log 2} = \frac{y \log 2}{\log 2}$$

$$\frac{\log(x - 5)}{\log 2} = h(x)$$

PTS: 4 REF: 082435aai NAT: F.BF.B.5 TOP: Inverse of Functions
KEY: exponential

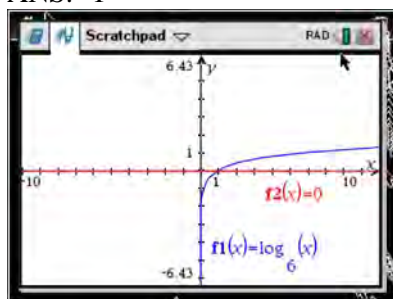
307 ANS: 2 PTS: 2 REF: 082511aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

308 ANS: 2 PTS: 2 REF: 082409aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

309 ANS: 1

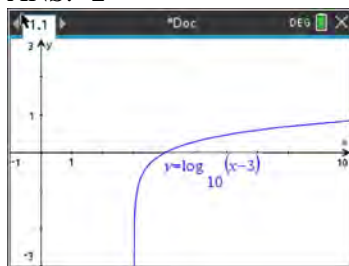


PTS: 2 REF: 061618aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

310 ANS: 4 PTS: 2 REF: 062215aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

311 ANS: 2



PTS: 2 REF: 062519aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

312 ANS: 1 PTS: 2 REF: 011902aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

313 ANS: 4
 $\log_2(x-1) - 1 = 0$

$$\log_2(x-1) = 1$$

$$x-1 = 2^1$$

$$x = 3$$

PTS: 2 REF: 061819aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

314 ANS: 1 PTS: 2 REF: 062308aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

315 ANS: 4

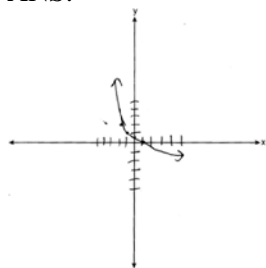
Translate the parent log function 2 to the right and reflect over the x -axis.

PTS: 2 REF: 082207aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

316 ANS:
 left 3, down 5

PTS: 2 REF: 012525aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

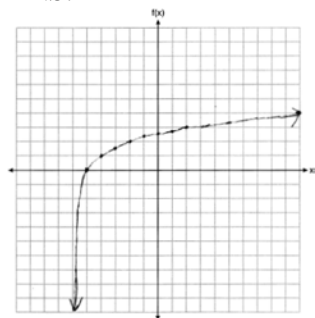
317 ANS:



As $x \rightarrow -3, y \rightarrow \infty$. As $x \rightarrow \infty, y \rightarrow -\infty$.

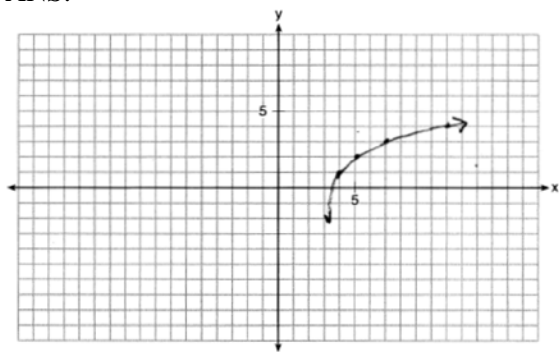
PTS: 4 REF: 082333aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

318 ANS:



PTS: 2 REF: 061927aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

319 ANS:



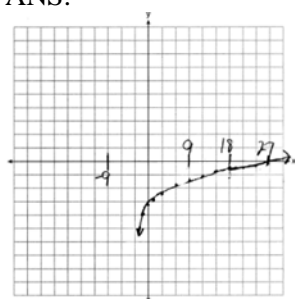
PTS: 2

REF: 011932aii

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

320 ANS:



As $x \rightarrow -3, y \rightarrow -\infty$. As $x \rightarrow \infty, y \rightarrow \infty$.

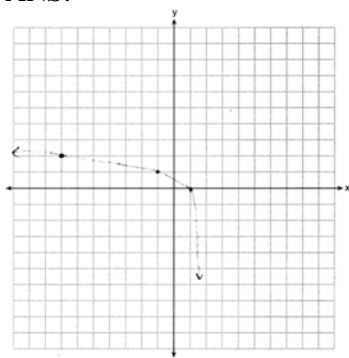
PTS: 4

REF: 061735aii

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

321 ANS:



Domain: $x < 2$, Asymptote $x = 2$

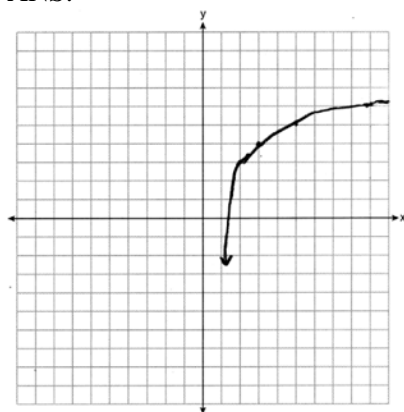
PTS: 4

REF: 012034aii

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

322 ANS:

 $x = 1, y = 1$

PTS: 4

REF: 062436aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

323 ANS: 3

PTS: 2

REF: 012404aai

NAT: F.LE.A.4

TOP: Express Exponentials as Logarithms

324 ANS: 1

$$\frac{n}{m} = 2$$

$$n = 2m$$

PTS: 2

REF: 062515aai

NAT: F.LE.A.4

TOP: Exponential Equations

325 ANS: 1

$$\log 3^{x+4} = \log 28$$

$$\frac{(x+4)\log 3}{\log 3} = \frac{\log 28}{\log 3}$$

$$x+4 = \frac{\log 28}{\log 3}$$

$$x = \log_3 28 - 4$$

PTS: 2

REF: 082306aai

NAT: F.LE.A.4

TOP: Exponential Equations

KEY: without common base

326 ANS: 3

$$10^{5x-2} = 3$$

$$\log 10^{5x-2} = \log 3$$

$$(5x-2)\log 10 = \log 3$$

$$5x-2 = \log 3$$

$$5x = \log 3 + 2$$

$$x = \frac{\log 3 + 2}{5}$$

PTS: 2 REF: 012517aii NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

327 ANS: 2

$$5(2)^{19x} = 50$$

$$\log_2 2^{19x} = \log_2 10$$

$$19x = \log_2 10$$

$$x = \frac{\log_2 10}{19}$$

PTS: 2 REF: 062503aii NAT: F.LE.A.4 TOP: Exponential Equations

328 ANS: 3

$$e^{bt} = \frac{c}{a}$$

$$\ln e^{bt} = \ln \frac{c}{a}$$

$$bt \ln e = \ln \frac{c}{a}$$

$$t = \frac{\ln \frac{c}{a}}{b}$$

PTS: 2 REF: 011813aii NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

329 ANS: 4

$$6(2^{x+4}) = 36$$

$$\ln 2^{x+4} = \ln 6$$

$$(x+4)\ln 2 = \ln 6$$

$$x+4 = \frac{\ln 6}{\ln 2}$$

$$x = \frac{\ln 6}{\ln 2} - 4$$

PTS: 2 REF: 082408aai NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

330 ANS: 1

$$8(2^{x+3}) = 48$$

$$2^{x+3} = 6$$

$$(x+3)\ln 2 = \ln 6$$

$$x+3 = \frac{\ln 6}{\ln 2}$$

$$x = \frac{\ln 6}{\ln 2} - 3$$

PTS: 2 REF: 061702aai NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

331 ANS: 3

$$9(e^{x-2}) = 36$$

$$\ln e^{x-2} = \ln 4$$

$$(x-2)\ln e = \ln 4$$

$$x = \ln 4 + 2$$

PTS: 2 REF: 082509aai NAT: F.LE.A.4 TOP: Exponential Equations

332 ANS: 1

$$\ln e^{x+2} = \ln \frac{7}{5}$$

$$(x+2)\ln e = \ln \frac{7}{5}$$

$$x = -2 + \ln \frac{7}{5}$$

PTS: 2 REF: 062207aai NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

333 ANS: 4

$$\ln e^{0.3x} = \ln \frac{5918}{87}$$

$$x = \frac{\ln \frac{5918}{87}}{0.3}$$

PTS: 2 REF: 081801aii NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

334 ANS: 2

$$4300e^{0.07x} = 5123$$

$$\ln e^{0.07x} = \ln \frac{5123}{4300}$$

$$0.07x = \ln \frac{5123}{4300}$$

$$x = \frac{\ln \frac{5123}{4300}}{0.07}$$

$$x \approx 2.5$$

PTS: 2 REF: 012302aii NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

335 ANS: 4

$$\log 2^t = \log \sqrt{10} \quad 2) \frac{\log \sqrt{10}}{\log 2} = \log_2 \sqrt{10}, \quad 1) \log_2 \sqrt{10} = \log_2 10^{\frac{1}{2}} = \frac{1}{2} \log_2 10, \quad 3) \log_4 10 = \frac{\log_2 10}{\log_2 4} = \frac{1}{2} \log_2 10$$

$$t \log 2 = \log \sqrt{10}$$

$$t = \frac{\log \sqrt{10}}{\log 2}$$

PTS: 2 REF: 012009aii NAT: F.LE.A.4 TOP: Exponential Equations
KEY: without common base

336 ANS:

$$a^{x+1} = a^{\frac{2}{3}}$$

$$x+1 = \frac{2}{3}$$

$$x = -\frac{1}{3}$$

PTS: 2 REF: 012326aii NAT: F.LE.A.4 TOP: Exponential Equations
KEY: common base shown

337 ANS:

$$\ln e^{0.49x} = \ln 7.5$$

$$0.49x = \ln 7.5$$

$$x = \frac{\ln 7.5}{0.49} \approx 4.112$$

PTS: 2 REF: 062330aai NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

338 ANS:

$$\ln e^{1.5t} = \ln \frac{16}{3.8}$$

$$1.5t = \ln \frac{16}{3.8}$$

$$t = \frac{\ln \frac{16}{3.8}}{1.5} \approx .96$$

PTS: 2 REF: 062426aai NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

339 ANS: 4

$$\frac{15000}{12000} = \frac{12000e^{.025t}}{12000}$$

$$1.25 = e^{.025t}$$

$$\ln 1.25 = \ln e^{.025t}$$

$$\ln 1.25 = .025t$$

$$\frac{\ln 1.25}{.025} = t$$

PTS: 2 REF: 082209aai NAT: F.LE.A.4 TOP: Exponential Growth

340 ANS: 1

$$9110 = 5000e^{30r}$$

$$\ln \frac{911}{500} = \ln e^{30r}$$

$$\frac{\ln \frac{911}{500}}{30} = r$$

$$r \approx .02$$

PTS: 2 REF: 011810aai NAT: F.LE.A.4 TOP: Exponential Growth

341 ANS:

$$4\% \quad 8.75 = 1.25(1+r)^{49} \text{ or } 8.75 = 1.25e^{49r}$$

$$7 = (1+r)^{49} \quad \ln 7 = \ln e^{49r}$$

$$r+1 = \sqrt[49]{7} \quad \ln 7 = 49r$$

$$r \approx .04 \quad r = \frac{\ln 7}{49}$$

$$r \approx .04$$

PTS: 2 REF: 081730aai NAT: F.LE.A.4 TOP: Exponential Growth

342 ANS:

$$A = Pe^{rt}$$

$$135000 = 100000e^{5r}$$

$$1.35 = e^{5r}$$

$$\ln 1.35 = \ln e^{5r}$$

$$\ln 1.35 = 5r$$

$$.06 \approx r \text{ or } 6\%$$

PTS: 2 REF: 061632aai NAT: F.LE.A.4 TOP: Exponential Growth

343 ANS:

$$2 = e^{0.0375t}$$

$$t \approx 18.5$$

PTS: 4 REF: 081835aai NAT: F.LE.A.4 TOP: Exponential Growth

344 ANS:

$$\text{a) } p(t) = 11000(2)^{\frac{t}{20}}; \text{ b) } \frac{1000000}{11000} = \frac{11000(2)^{\frac{t}{20}}}{11000}$$

$$\log \frac{1000}{11} = \log 2^{\frac{t}{20}}$$

$$\log \frac{1000}{11} = \frac{t \cdot \log 2}{20}$$

$$\frac{20 \log \frac{1000}{11}}{\log 2} = t$$

$$t \approx 130.13$$

PTS: 4 REF: 082233aai NAT: F.LE.A.4 TOP: Exponential Growth

345 ANS:

$$C(t) = 63000 \left(1 + \frac{0.0255}{12}\right)^{12t} = 63000 \left(1 + \frac{0.0255}{12}\right)^{12t} = 100000$$

$$12t \log(1.002125) = \log \frac{100}{63}$$

$$t \approx 18.14$$

PTS: 4

REF: 061835aia

NAT: F.LE.A.4

TOP: Exponential Growth

346 ANS:

$$A = 5000(1.045)^n \quad 5000 \left(1 + \frac{.046}{4}\right)^{4(6)} - 5000(1.045)^6 \approx 6578.87 - 6511.30 \approx 67.57 \quad 10000 = 5000 \left(1 + \frac{.046}{4}\right)^{4n}$$

$$B = 5000 \left(1 + \frac{.046}{4}\right)^{4n}$$

$$2 = 1.0115^{4n}$$

$$\log 2 = 4n \cdot \log 1.0115$$

$$n = \frac{\log 2}{4 \log 1.0115}$$

$$n \approx 15.2$$

PTS: 6

REF: 081637aia

NAT: F.LE.A.4

TOP: Exponential Growth

347 ANS:

$$A(t) = 8000 \left(1 + \frac{.042}{4}\right)^{4t} \quad A(18) = 16970.900 \quad 24000 = 8000e^{.039t}$$

$$B(t) = 8000e^{.039t} \quad B(18) = \underline{16142.274} \quad \ln 3 = \ln e^{.039t}$$

$$828.63 \quad \ln 3 = .039t$$

$$t \approx 28.2$$

PTS: 6

REF: 082337aia

NAT: F.LE.A.4

TOP: Exponential Growth

348 ANS:

$$A(t) = 1200 \left(1 + \frac{6.4\%}{4}\right)^{4t} \quad \text{Barnyard because } A(10) \approx 2264.28$$

$$3 = e^{6.35\% t}$$

$$B(t) = 1200e^{6.35\% t}$$

$$B(10) = 2264.43$$

$$\ln 3 = \ln e^{6.35\% t}$$

$$\ln 3 = 0.635t$$

$$\frac{\ln 3}{0.635} = \frac{0.635t}{0.635}$$

$$t \approx 17.3$$

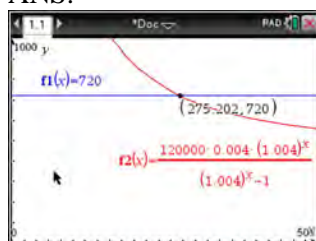
PTS: 6

REF: 082437aia

NAT: F.LE.A.4

TOP: Exponential Growth

349 ANS:



$$720 = \frac{120000 \left(\frac{.048}{12} \right) \left(1 + \frac{.048}{12} \right)^n}{\left(1 + \frac{.048}{12} \right)^n - 1} \frac{275.2}{12} \approx 23 \text{ years}$$

$$720(1.004)^n - 720 = 480(1.004)^n$$

$$240(1.004)^n = 720$$

$$1.004^n = 3$$

$$n \log 1.004 = \log 3$$

$$n \approx 275.2 \text{ months}$$

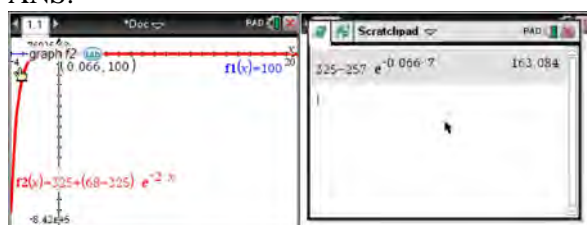
PTS: 4

REF: spr1509aii

NAT: F.LE.A.4

TOP: Exponential Growth

350 ANS:



$$100 = 325 + (68 - 325)e^{-2k} \quad T = 325 - 257e^{-0.066t}$$

$$-225 = -257e^{-2k}$$

$$T = 325 - 257e^{-0.066(7)} \approx 163$$

$$k = \frac{\ln\left(\frac{-225}{-257}\right)}{-2}$$

$$k \approx 0.066$$

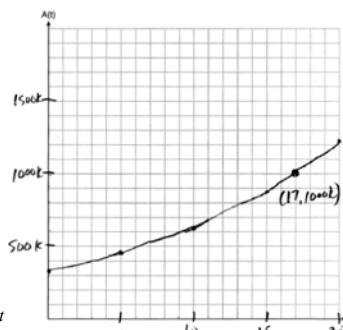
PTS: 4

REF: fall1513aii

NAT: F.LE.A.4

TOP: Exponential Growth

351 ANS:



$$A(t) = 318000(1.07)^t$$

$318000(1.07)^t = 1000000$ The graph of $A(t)$ nearly intersects

$$1.07^t = \frac{1000}{318}$$

$$t \log 1.07 = \log \frac{1000}{318}$$

$$t = \frac{\log \frac{1000}{318}}{\log 1.07}$$

$$t \approx 17$$

the point (17, 1000000).

PTS: 6

REF: 011937aai

NAT: F.LE.A.4

TOP: Exponential Growth

352 ANS: 1

$$50(.9)^t = 25$$

$$t \approx 6.57$$

PTS: 2

REF: 082317aai

NAT: F.LE.A.4

TOP: Exponential Decay

353 ANS: 1

$$100\left(\frac{1}{2}\right)^{\frac{d}{8}} = 100e^{kd}$$

$$\left(\frac{1}{2}\right)^{\frac{1}{8}} = e^k$$

$$k \approx -0.087$$

PTS: 2

REF: 061818aai

NAT: F.LE.A.4

TOP: Exponential Decay

354 ANS: 4

$$120 = 68 + (195 - 68)e^{-0.05t}$$

$$52 = 127e^{-0.05t}$$

$$\ln \frac{52}{127} = \ln e^{-0.05t}$$

$$\ln \frac{52}{127} = -0.05t$$

$$\frac{\ln \frac{52}{127}}{-0.05} = t$$

$$18 \approx t$$

PTS: 2

REF: 081918aai

NAT: F.LE.A.4

TOP: Exponential Decay

355 ANS:

$$7 = 20(0.5)^{\frac{t}{8.02}}$$

$$\log 0.35 = \log 0.5^{\frac{t}{8.02}}$$

$$\log 0.35 = \frac{t \log 0.5}{8.02}$$

$$\frac{8.02 \log 0.35}{\log 0.5} = t$$

$$t \approx 12$$

PTS: 4

REF: 081634aai

NAT: F.LE.A.4

TOP: Exponential Decay

356 ANS:

$$s(t) = 200(0.5)^{\frac{t}{15}} \quad \frac{1}{10} = (0.5)^{\frac{t}{15}}$$

$$\log \frac{1}{10} = \log(0.5)^{\frac{t}{15}}$$

$$-1 = \frac{t \cdot \log(0.5)}{15}$$

$$t = \frac{-15}{\log(0.5)} \approx 50$$

PTS: 4

REF: 061934aai

NAT: F.LE.A.4

TOP: Exponential Decay

357 ANS:

$$100 = 140 \left(\frac{1}{2} \right)^{\frac{5}{h}} \quad \log \frac{100}{140} = \log \left(\frac{1}{2} \right)^{\frac{5}{h}} \quad 40 = 140 \left(\frac{1}{2} \right)^{\frac{t}{10.3002}}$$

$$\log \frac{5}{7} = \frac{5}{h} \log \frac{1}{2} \quad \log \frac{2}{7} = \log \left(\frac{1}{2} \right)^{\frac{t}{10.3002}}$$

$$h = \frac{5 \log \frac{1}{2}}{\log \frac{5}{7}} \approx 10.3002 \quad \log \frac{2}{7} = \frac{t \log \left(\frac{1}{2} \right)}{10.3002}$$

$$t = \frac{10.3002 \log \frac{2}{7}}{\log \frac{1}{2}} \approx 18.6$$

PTS: 6 REF: 061737aia NAT: F.LE.A.4 TOP: Exponential Decay

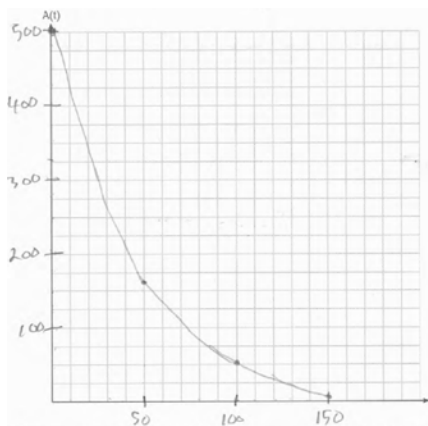
358 ANS:

$$112 = 73 + (237 - 73)e^{-1.5k} \quad T(2.5) = 73 + (237 - 73)e^{(-.958)(2.5)} \approx 88 \quad 80 = 73 + (237 - 73)e^{-.958t}$$

$$k \approx .958 \quad t \approx 3.3$$

PTS: 6 REF: 062437aia NAT: F.LE.A.4 TOP: Exponential Decay

359 ANS:



$$125 = 500e^{k(60.34)} \quad A(t) = 500e^{-.023t} \quad \frac{A(60) - A(0)}{60 - 0} \approx -6.2 \quad \text{The mass of}$$

$$k \approx -.023$$

Cesium-137 decreases about 6.2 grams per year.

PTS: 6 REF: 062537aia NAT: F.LE.A.4 TOP: Exponential Decay

360 ANS: 1

$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

$$x = -4, 2$$

PTS: 2 REF: 081701aii NAT: A.APR.D.6 TOP: Undefined Rationals

361 ANS: 4

$$\frac{x^2 - 4x}{2x} = \frac{x(x-4)}{2x} = \frac{x-4}{2} = \frac{x}{2} - 2 = \frac{x-1}{2} - \frac{3}{2} = \frac{x-1-3}{2} = \frac{x-4}{2}$$

PTS: 2 REF: 011921aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

362 ANS: 1

$$\frac{x(x^2 - 9)}{-(x^2 - 9)} = -x$$

PTS: 2 REF: 012023aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

363 ANS: 2

$$\frac{x^2 + 3x}{x^2 + 5x + 6} = \frac{x(x+3)}{(x+2)(x+3)}$$

PTS: 2 REF: 082215aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

364 ANS: 4

$$\frac{-3x^2 - 5x + 2}{x^3 + 2x^2} = \frac{(-3x+1)(x+2)}{x^2(x+2)} = \frac{-3x}{x^2} + \frac{1}{x^2} = -3x^{-1} + x^{-2}$$

PTS: 2 REF: 061723aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

365 ANS: 3

$$\frac{x^2(x+2) - 9(x+2)}{x(x^2 - x - 6)} = \frac{(x^2 - 9)(x+2)}{x(x-3)(x+2)} = \frac{(x+3)(x-3)}{x(x-3)} = \frac{x+3}{x}$$

PTS: 2 REF: 061803aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

366 ANS: 1

$$1) (x+3)^2 - 16 = x^2 + 6x + 9 - 16 = x^2 + 6x - 7 = (x+7)(x-1); 2) \quad u = x+3 \quad ; 3)$$

$$u^2 - 10u - 2u + 20$$

$$u(u-10) - 2(u-10)$$

$$(u-2)(u-10)$$

$$(x+3-2)(x+3-10)$$

$$(x+1)(x-7)$$

$$\frac{(x-1)(x-7)(x+1)}{(x+1)} = (x-1)(x-7); 4) \frac{(x+7)(x+1)(x+3)}{(x+3)} = (x+7)(x+1)$$

PTS: 2 REF: 061808aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

367 ANS: 3

$$1) \frac{(x+2)(x^2 - 2x - 24)}{(x+4)} = \frac{(x+2)(x-6)(x+4)}{(x+4)}; 3) \frac{(x-2)(x^2 - 4x - 12)}{(x-6)} = \frac{(x-2)(x-6)(x+2)}{(x-6)}; 4)$$

$$(x+4)(x-2) - 2(3x+2) = x^2 + 2x - 8 - 6x - 4 = x^2 - 4x - 12 = (x-6)(x+2)$$

PTS: 2 REF: 082506aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

368 ANS:

$$\frac{x^2(2x+1) - 9(2x+1)}{x(3-x)} = \frac{(x^2-9)(2x+1)}{x(3-x)} = \frac{(x+3)(x-3)(2x+1)}{x(3-x)} = \frac{(x+3)(2x+1)}{-x}$$

PTS: 2 REF: 062331ai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

369 ANS: 3

$$\frac{c^2 - d^2}{d^2 + cd - 2c^2} = \frac{(c+d)(c-d)}{(d+2c)(d-c)} = \frac{-(c+d)}{d+2c} = \frac{-c-d}{d+2c}$$

PTS: 2 REF: 011818aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

370 ANS: 1

$$\frac{x^2 + 3xy - 28y^2}{16y^2 - x^2} = \frac{(x+7y)(x-4y)}{(4y+x)(4y-x)} = \frac{-(x+7y)}{4y+x} = \frac{-x-7y}{x+4y}$$

PTS: 2 REF: 062523aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

371 ANS: 3

$$\begin{array}{r}
 2x+1 \\
 x+2 \overline{) 2x^2+5x+8} \\
 \underline{2x^2+4x} \\
 x+8 \\
 \underline{x+2} \\
 6
 \end{array}$$

PTS: 2 REF: 012007aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

372 ANS: 1

$$\begin{array}{r}
 2x^2+3x+4 \\
 x-3 \overline{) 2x^3-3x^2-5x-12} \\
 \underline{2x^3-6x^2} \\
 3x^2-5x \\
 \underline{3x^2-9x} \\
 4x-12 \\
 \underline{4x-12} \\
 0
 \end{array}$$

PTS: 2 REF: 012505aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

373 ANS: 2

$$\begin{array}{r}
 x^2+0x+1 \\
 x+2 \overline{) x^3+2x^2+x+6} \\
 \underline{x^3+2x^2} \\
 0x^2+x \\
 \underline{0x^2+0x} \\
 x+6 \\
 \underline{x+2} \\
 4
 \end{array}$$

PTS: 2 REF: 081611aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

374 ANS: 1

$$\begin{array}{r}
 \overline{2x^2 + 4x + 3} \\
 x+1 \overline{) 2x^3 + 6x^2 + 7x + 2} \\
 \underline{2x^3 + 2x^2} \\
 4x^2 + 7x \\
 \underline{4x^2 + 4x} \\
 3x + 2 \\
 \underline{3x + 3} \\
 -1
 \end{array}$$

PTS: 2 REF: 062508aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

375 ANS: 2

$$\begin{array}{r}
 \overline{2x^2 - 3x + 5} \\
 x+3 \overline{) 2x^3 + 3x^2 - 4x + 5} \\
 \underline{2x^3 + 6x^2} \\
 -3x^2 - 4x \\
 \underline{-3x^2 - 9x} \\
 5x + 5 \\
 \underline{5x + 15} \\
 -10
 \end{array}$$

PTS: 2 REF: 082302aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

376 ANS: 1

$$\begin{array}{r}
 \overline{2x^2 + x - 6} \\
 x+3 \overline{) 2x^3 + 7x^2 - 3x - 25} \\
 \underline{2x^3 + 6x^2} \\
 x^2 - 3x \\
 \underline{ x^2 + 3x} \\
 -6x - 25 \\
 \underline{ -6x - 18} \\
 -7
 \end{array}$$

PTS: 2 REF: 062203aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

377 ANS: 3

$$\begin{array}{r}
 \overline{2x^3 - 4x^2 - x + \frac{14}{x+6}} \\
 x+6 \overline{) 2x^4 + 8x^3 - 25x^2 - 6x + 14} \\
 \underline{2x^4 + 12x^3} \\
 -4x^3 - 25x^2 \\
 \underline{ -4x^3 - 24x^2} \\
 -x^2 - 6x \\
 \underline{ -x^2 - 6x} \\
 14
 \end{array}$$

PTS: 2 REF: 081805aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

378 ANS: 2

$$\begin{array}{r}
 x^2 + 2x + 4 \\
 x - 2 \overline{) x^3 - 0x^2 + 0x - 2} \\
 \underline{x^3 - 2x^2} \\
 2x^2 + 0x \\
 \underline{2x^2 - 4x} \\
 4x - 2 \\
 \underline{4x - 8} \\
 6
 \end{array}$$

PTS: 2 REF: 082217aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

379 ANS: 1

$$\begin{array}{r}
 x^3 - 2x^2 - x + 6 \\
 x + 2 \overline{) x^4 + 0x^3 - 5x^2 + 4x + 14} \\
 \underline{x^4 + 2x^3} \\
 -2x^3 - 5x^2 \\
 \underline{-2x^3 - 4x^2} \\
 -x^2 + 4x \\
 \underline{-x^2 - 2x} \\
 6x + 14 \\
 \underline{6x + 12} \\
 2
 \end{array}$$

PTS: 2 REF: 012305aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

380 ANS: 2

$$\begin{array}{r}
 2x^3 + 6x^2 + 13x + 42 \\
 x - 3 \overline{) 2x^4 + 0x^3 - 5x^2 + 3x - 2} \\
 \underline{2x^4 - 6x^3} \\
 6x^3 - 5x^2 \\
 \underline{6x^3 - 18x^2} \\
 13x^2 + 3x - 2 \\
 \underline{13x^2 - 39x} \\
 42x - 2 \\
 \underline{42x - 126} \\
 124
 \end{array}$$

PTS: 2 REF: 012408aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

381 ANS: 4

$$\begin{array}{r}
 6x^3 - 8x^2 + 16x - 31 \\
 x + 2 \overline{) 6x^4 + 4x^3 + 0x^2 + x + 200} \\
 \underline{6x^4 + 12x^3} \\
 -8x^3 + 0x^2 \\
 \underline{-8x^3 - 16x^2} \\
 16x^2 + x \\
 \underline{16x^2 + 32x} \\
 -31x + 200 \\
 \underline{-31x - 62} \\
 262
 \end{array}$$

PTS: 2 REF: 082407aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

382 ANS: 4

$$\begin{array}{r}
 \overline{) 10x^3 - 3x^2 - 7x + 3} \\
 \underline{10x^3 - 5x^2} \\
 2x^2 - 7x \\
 \underline{2x^2 - x} \\
 -6x + 3 \\
 \underline{-6x + 3} \\
 0
 \end{array}$$

PTS: 2 REF: 011809aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

383 ANS: 4

$$\begin{array}{r}
 \overline{) 6x^3 + 7x^2 - 9x - 1} \\
 \underline{6x^3 - 3x^2} \\
 10x^2 - 9x - 1 \\
 \underline{10x^2 - 5x} \\
 -4x - 1 \\
 \underline{-4x + 2} \\
 -3
 \end{array}$$

PTS: 2 REF: 082512aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

384 ANS: 1

$$\begin{array}{r}
 \overline{) 6x^3 + 17x^2 + 10x + 2} \\
 \underline{6x^3 + 9x^2} \\
 8x^2 + 10x + 2 \\
 \underline{8x^2 + 12x} \\
 -2x + 2 \\
 \underline{-2x - 3} \\
 5
 \end{array}$$

PTS: 2 REF: fall1503aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

385 ANS: 1

$$\begin{array}{r}
 \overline{) 9x^2 + 0x - 2} \\
 \underline{3x - 1} \\
 9x^2 + 0x - 2 \\
 \underline{9x^2 + 3x} \\
 -3x - 2 \\
 \underline{-3x - 1} \\
 -1
 \end{array}$$

PTS: 2 REF: 081910aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

386 ANS: 1

$$\begin{array}{r}
 \overline{) 2x^3 + 0x^2 + 2x - 7} \\
 \underline{x^2 - 2x + 5} \\
 2x^3 + 0x^2 + 2x - 7 \\
 \underline{2x^3 + 4x^2} \\
 -4x^2 + 2x - 7 \\
 \underline{-4x^2 - 8x} \\
 10x - 7 \\
 \underline{10x + 20} \\
 -27
 \end{array}$$

PTS: 2 REF: 062313aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

387 ANS: 1

$$\begin{array}{r}
 \overline{) 4x^3 + 0x^2 + 9x - 5} \\
 \underline{2x^2 + x + 5} \\
 4x^3 + 0x^2 + 9x - 5 \\
 \underline{4x^3 - 2x^2} \\
 2x^2 + 9x - 5 \\
 \underline{2x^2 - x} \\
 10x - 5 \\
 \underline{10x - 5} \\
 0
 \end{array}$$

PTS: 2 REF: 081713aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

388 ANS: 2

$$\begin{array}{r}
 2x^2 - 3x + 7 \\
 2x + 3 \overline{) 4x^3 + 0x^2 + 5x + 10} \\
 \underline{4x^3 + 6x^2} \\
 -6x^2 + 5x \\
 \underline{-6x^2 - 9x} \\
 14x + 10 \\
 \underline{14x + 21} \\
 -11
 \end{array}$$

PTS: 2 REF: 061614aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

389 ANS:

$$\begin{array}{r}
 3x + 13 \\
 x - 2 \overline{) 3x^2 + 7x - 20} \quad 3x + 13 + \frac{6}{x-2} \\
 \underline{3x^2 - 6x} \\
 13x - 20 \\
 \underline{13x - 26} \\
 6
 \end{array}$$

PTS: 2 REF: 011732aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

390 ANS:

$$\begin{array}{r}
 2a^2 + 5a + 2 \\
 3a - 2 \overline{) 6a^3 + 11a^2 - 4a - 9} \quad 2a^2 + 5a + 2 - \frac{5}{3a-2} \\
 \underline{6a^3 - 4a^2} \\
 15a^2 - 4a \\
 \underline{15a^2 - 10a} \\
 6a - 9 \\
 \underline{6a - 4} \\
 -5
 \end{array}$$

PTS: 2 REF: 061829aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

391 ANS:

$$\begin{array}{r}
 3x^2 + 8x + 34 \\
 x - 4 \overline{) 3x^3 - 4x^2 + 2x - 1} \\
 \underline{3x^3 - 12x^2} \\
 8x^2 + 2x - 1 \\
 \underline{8x^2 - 32x} \\
 34x - 1 \\
 \underline{34x - 136} \\
 135
 \end{array}$$

$x = 4$ is not a root of $f(x)$ because $\frac{f(x)}{g(x)}$ has a remainder.

PTS: 4 REF: 082235aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

392 ANS:

$$\begin{array}{r}
 x^3 + 4 \\
 x + 2 \overline{) x^4 + 2x^3 + 4x - 10} \\
 \underline{x^4 + 2x^3} \\
 4x - 10 \\
 \underline{4x + 8} \\
 -18
 \end{array}$$

$x^3 + 4 - \frac{18}{x+2}$. No, because there is a remainder.

PTS: 4 REF: 011934aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

393 ANS:

$$\frac{p(x)}{x-1} = x^2 + 7 + \frac{5}{x-1}$$

$$p(x) = x^3 - x^2 + 7x - 7 + 5$$

$$p(x) = x^3 - x^2 + 7x - 2$$

PTS: 2 REF: 061930aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

394 ANS: 2

$$\frac{x^2 + 12}{x^2 + 3} = \frac{x^2 + 3}{x^2 + 3} + \frac{9}{x^2 + 3} = 1 + \frac{9}{x^2 + 3}$$

PTS: 2 REF: 062218aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: addition and subtraction

395 ANS: 4

$$\frac{x^2+6}{x^2+4} = \frac{x^2+4}{x^2+4} + \frac{2}{x^2+4} = 1 + \frac{2}{x^2+4}$$

PTS: 2 REF: 082321aii NAT: A.APR.D.6 TOP: Rational Expressions
KEY: addition and subtraction

396 ANS: 1

$$\frac{4x^2-5}{x^2-1} = \frac{4(x^2-1)}{x^2-1} - \frac{1}{x^2-1}$$

PTS: 2 REF: 012510aii NAT: A.APR.D.6 TOP: Rational Expressions
KEY: addition and subtraction

397 ANS: 2

$$2 - \frac{x-1}{x+2} = 1 + \frac{x+2}{x+2} - \frac{x-1}{x+2} = 1 + \frac{x+2-(x-1)}{x+2} = 1 + \frac{3}{x+2}$$

PTS: 2 REF: 081907aii NAT: A.APR.D.6 TOP: Rational Expressions
KEY: addition and subtraction

398 ANS:

$$\frac{x^3+9}{x^3+8} = \frac{x^3+8}{x^3+8} + \frac{1}{x^3+8}$$

$$\frac{x^3+9}{x^3+8} = \frac{x^3+9}{x^3+8}$$

PTS: 2 REF: 061631aii NAT: A.APR.D.6 TOP: Rational Expressions
KEY: addition and subtraction

399 ANS: 3 PTS: 2 REF: 061722aii NAT: A.CED.A.1

TOP: Modeling Rationals

400 ANS: 3 PTS: 2 REF: 061824aii NAT: A.CED.A.1

TOP: Modeling Rationals

401 ANS: 3 PTS: 2 REF: 061602aii NAT: A.CED.A.1

TOP: Modeling Rationals

402 ANS: 1 PTS: 2 REF: 082510aii NAT: A.CED.A.1

TOP: Modeling Rationals

403 ANS: 2 PTS: 2 REF: 082222aii NAT: A.CED.A.1

TOP: Modeling Rationals

404 ANS: 4 PTS: 2 REF: 062516aii NAT: A.CED.A.1

TOP: Modeling Rationals

405 ANS: 1

$$x - \frac{20}{x} = 8$$

$$x^2 - 8x - 20 = 0$$

$$(x - 10)(x + 2) = 0$$

$$x = 10, -2$$

PTS: 2

REF: 061916aaii

NAT: A.CED.A.1

TOP: Modeling Rationals

406 ANS: 2

$$\frac{1}{x} - \frac{1}{5} = \frac{x}{5} \quad b^2 - 4ac = 1^2 - 4(1)(-5) = 1 + 20 = 21, \text{ which is not a perfect square.}$$

$$\frac{1}{x} = \frac{x+1}{5}$$

$$x^2 + x = 5$$

$$x^2 + x - 5 = 0$$

PTS: 2

REF: 062522aaii

NAT: A.REI.A.2

TOP: Solving Rationals

407 ANS: 3

$$\frac{1}{J} = \frac{1}{F} - \frac{1}{W}$$

$$\frac{1}{J} = \frac{W-F}{FW}$$

$$J = \frac{FW}{W-F}$$

PTS: 2

REF: 081617aaii

NAT: A.REI.A.2

TOP: Solving Rationals

KEY: rational solutions

408 ANS: 4

$$\frac{2}{x} = \frac{4x}{x+3}$$

$$2x + 6 = 4x^2$$

$$4x^2 - 2x - 6 = 0$$

$$2(2x^2 - x - 3) = 0$$

$$(2x - 3)(x + 1) = 0$$

$$x = \frac{3}{2}, -1$$

PTS: 2

REF: 061809aaii

NAT: A.REI.A.2

TOP: Solving Rationals

409 ANS: 3

$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1} - \frac{1}{3} \text{ is extraneous.}$$

$$\frac{6x+2}{3x+1} = \frac{1}{x}$$

$$6x^2 + 2x = 3x + 1$$

$$6x^2 - x - 1 = 0$$

$$(2x-1)(3x+1) = 0$$

$$x = \frac{1}{2}, -\frac{1}{3}$$

PTS: 2 REF: 011915aai NAT: A.REI.A.2 TOP: Solving Rationals

410 ANS: 4

$$x(x+7) \left[\frac{3x+25}{x+7} - 5 = \frac{3}{x} \right]$$

$$x(3x+25) - 5x(x+7) = 3(x+7)$$

$$3x^2 + 25x - 5x^2 - 35x = 3x + 21$$

$$2x^2 + 13x + 21 = 0$$

$$(2x+7)(x+3) = 0$$

$$x = -\frac{7}{2}, -3$$

PTS: 2 REF: fall1501aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

411 ANS: 3

$$\frac{x+2}{x} + \frac{x}{3} = \frac{2x^2+6}{3x} \text{ 0 is extraneous.}$$

$$\frac{x^2+3x+6}{3x} = \frac{2x^2+6}{3x}$$

$$x^2 + 3x + 6 = 2x^2 + 6$$

$$x^2 - 3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

PTS: 2 REF: 012309aai NAT: A.REI.A.2 TOP: Solving Rationals

412 ANS: 4

$$x(x-2)\left(\frac{10}{x^2-2x} + \frac{4}{x} = \frac{5}{x-2}\right) \text{ 2 is extraneous.}$$

$$10 + 4(x-2) = 5x$$

$$10 + 4x - 8 = 5x$$

$$2 = x$$

PTS: 2 REF: 081915aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

413 ANS: 1

$$\frac{(x+3)(x+2)}{(x-5)(x+2)} + \frac{6(x-5)}{(x+2)(x-5)} = \frac{6+10x}{(x-5)(x+2)} \text{ 5 is extraneous.}$$

$$x^2 + 5x + 6 + 6x - 30 = 10x + 6$$

$$x^2 + x - 30 = 0$$

$$(x+6)(x-5) = 0$$

$$x = -6, 5$$

PTS: 2 REF: 062319aai NAT: A.REI.A.2 TOP: Solving Rationals

414 ANS: 4

$$\frac{x(x-4)}{(x+3)(x-4)} + \frac{2(x+3)}{(x-4)(x+3)} = \frac{2x+27}{(x-4)(x+3)} \text{ -3 is extraneous.}$$

$$x^2 - 4x + 2x + 6 = 2x + 27$$

$$x^2 - 2x + 6 = 2x + 27$$

$$x^2 - 4x - 21 = 0$$

$$(x-7)(x+3) = 0$$

$$x = 7, -3$$

PTS: 2 REF: 082405aai NAT: A.REI.A.2 TOP: Solving Rationals

415 ANS: 1

$$\frac{2(x-4)}{(x+3)(x-4)} + \frac{3(x+3)}{(x-4)(x+3)} = \frac{2x-2}{x^2-x-12}$$

$$2x - 8 + 3x + 9 = 2x - 2$$

$$3x = -3$$

$$x = -1$$

PTS: 2 REF: 011717aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

416 ANS: 3

$$\frac{4}{k^2 - 8k + 12} = \frac{k(k-6) + (k-2)}{k^2 - 8k + 12} \quad k = 6 \text{ is extraneous}$$

$$4 = k^2 - 6k + k - 2$$

$$0 = k^2 - 5k - 6$$

$$0 = (k-6)(k+1)$$

$$k = 6, -1$$

PTS: 2

REF: 082218aai

NAT: A.REI.A.2

TOP: Solving Rationals

417 ANS: 3

$$\left(x^2 - 49\right) \left(\frac{7}{x+7} + \frac{4x}{x-7} = \frac{3x+7}{x-7} \right)$$

$$7(x-7) + 4x(x+7) = (3x+7)(x+7)$$

$$7x - 49 + 4x^2 + 28x = 3x^2 + 21x + 7x + 49$$

$$4x^2 + 35x - 49 = 3x^2 + 28x + 49$$

$$x^2 + 7x - 98 = 0$$

$$(x+14)(x-7) = 0$$

$$x = -14, 7$$

PTS: 2

REF: 012422aai

NAT: A.REI.A.2

TOP: Solving Rationals

418 ANS: 1

$$\frac{2x}{x-2} \left(\frac{x}{x} \right) - \frac{11}{x} \left(\frac{x-2}{x-2} \right) = \frac{8}{x^2 - 2x}$$

$$2x^2 - 11x + 22 = 8$$

$$2x^2 - 11x + 14 = 0$$

$$(2x-7)(x-2) = 0$$

$$x = \frac{7}{2}, 2$$

PTS: 2

REF: 061719aai

NAT: A.REI.A.2

TOP: Solving Rationals

419 ANS: 1

$$x - \frac{4}{x-1} = 2 \quad x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2}$$

$$x(x-1) - 4 = 2(x-1)$$

$$x^2 - x - 4 = 2x - 2$$

$$x^2 - 3x - 2 = 0$$

PTS: 2 REF: 011812aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

420 ANS: 3

$$\frac{2}{x^3} + \frac{1}{x} = \frac{6}{x^3} \quad 0 \text{ is extraneous.}$$

$$\frac{1}{x} = \frac{4}{x^3}$$

$$x^3 = 4x$$

$$x^3 - 4x = 0$$

$$x(x^2 - 4) = 0$$

$$x = -2, 0, 2$$

PTS: 2 REF: 082508aai NAT: A.REI.A.2 TOP: Solving Rationals

421 ANS:

$$\frac{1}{x} - \frac{1}{3} = -\frac{1}{3x}$$

$$\frac{3-x}{3x} = -\frac{1}{3x}$$

$$3-x = -1$$

$$x = 4$$

PTS: 2 REF: 061625aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

422 ANS:

$$6x \left(\frac{1}{2x} - \frac{5}{6} = \frac{3}{x} \right)$$

$$3 - 5x = 18$$

$$-15 = 5x$$

$$-3 = x$$

PTS: 2 REF: 012526aai NAT: A.REI.A.2 TOP: Solving Rationals

423 ANS:

$$\frac{3}{n} = \frac{2}{n^2} \quad 0 \text{ is an extraneous solution.}$$

$$3n^2 = 2n$$

$$3n^2 - 2n = 0$$

$$n(3n - 2) = 0$$

$$n = 0, \frac{2}{3}$$

PTS: 2

REF: 062227aai

NAT: A.REI.A.2

TOP: Solving Rationals

424 ANS:

$$\frac{3p}{p-5} = \frac{p+2}{p+3}$$

$$3p^2 + 9p = p^2 - 3p - 10$$

$$2p^2 + 12p + 10 = 0$$

$$p^2 + 6p + 5 = 0$$

$$(p+5)(p+1) = 0$$

$$p = -5, -1$$

PTS: 4

REF: 081733aai

NAT: A.REI.A.2

TOP: Solving Rationals

KEY: rational solutions

425 ANS:

$$\frac{8x - 3(x+5)}{x(x+5)} = 5$$

$$8x - 3x - 15 = 5x^2 + 25x$$

$$0 = 5x^2 + 20x + 15$$

$$0 = x^2 + 4x + 3$$

$$0 = (x+3)(x+1)$$

$$x = -3, -1$$

PTS: 2

REF: 062430aai

NAT: A.REI.A.2

TOP: Solving Rationals

426 ANS:

$$\frac{7}{2x} - \frac{2}{x+1} = \frac{1}{4}$$

$$\frac{7x+7-4x}{2x^2+2x} = \frac{1}{4}$$

$$2x^2 + 2x = 12x + 28$$

$$x^2 - 5x - 14 = 0$$

$$(x-7)(x+2) = 0$$

$$x = 7, -2$$

PTS: 2 REF: 061926aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

427 ANS:

$$-6(x+3)\left(\frac{-3}{x+3} - \frac{x}{6} + 1 = 0\right)$$

$$18 + x(x+3) - 6(x+3) = 0$$

$$18 + x^2 + 3x - 6x - 18 = 0$$

$$x^2 - 3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

PTS: 2 REF: 081829aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

428 ANS:

$$\frac{x-2}{(x-6)(x-2)} + \frac{x(x-6)}{(x-6)(x-2)} = \frac{4}{(x-6)(x-2)}. \quad 6 \text{ is extraneous.}$$

$$x-2+x^2-6x=4$$

$$x^2-5x-6=0$$

$$(x-6)(x+1)=0$$

$$x = 6, -1$$

PTS: 4 REF: 082334aai NAT: A.REI.A.2 TOP: Solving Rationals

429 ANS:

$$\frac{2}{x} = \frac{2x+3}{x-4} \quad x = \frac{-1 \pm \sqrt{1^2 - 4(2)(8)}}{2(2)} = \frac{-1 \pm \sqrt{-63}}{4} = -\frac{1}{4} \pm \frac{3i\sqrt{7}}{4}$$

$$2x^2 + 3x = 2x - 8$$

$$2x^2 + x + 8 = 0$$

PTS: 4 REF: 062533aai NAT: A.REI.A.2 TOP: Solving Rationals

430 ANS:

$$\frac{55}{t} = \frac{65}{t+3}$$

$$65t = 55t + 165$$

$$10t = 165$$

$$t = 16.5$$

$$t+3 = 19.5$$

PTS: 2 REF: 082431aai NAT: A.REI.A.2 TOP: Solving Rationals

431 ANS:

$$\frac{1}{8} + \frac{1}{6} = \frac{1}{t_b}; \quad \frac{24t_b}{8} + \frac{24t_b}{6} = \frac{24t_b}{t_b}$$

$$3t_b + 4t_b = 24$$

$$t_b = \frac{24}{7} \approx 3.4$$

PTS: 2 REF: 011827aai NAT: A.REI.A.2 TOP: Solving Rationals

432 ANS: 4

$$\frac{1}{2}x^2 + 2x = \frac{1}{4}x - 8 \quad b^2 - 4ac$$

$$2x^2 + 8x = x - 32 \quad 7^2 - 4(2)(32) < 0$$

$$2x^2 + 7x + 32 = 0$$

PTS: 2 REF: 012310aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

433 ANS: 2

$$x^2 - 24 = x - 12 \quad y = -3 - 12 = -15$$

$$x^2 - x - 12 = 0$$

$$(x-4)(x+3) = 0$$

$$x = 4, -3$$

PTS: 2 REF: 062404aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

434 ANS: 2

$$x^2 + 4x - 1 = x - 3 \quad y + 3 = -1$$

$$x^2 + 3x + 2 = 0 \quad y = -4$$

$$(x + 2)(x + 1) = 0$$

$$x = -2, -1$$

PTS: 2

REF: 061801aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

435 ANS: 3

$$(x + 4)^2 - 10 = 3x + 6 \quad y = 3(-5) + 6 = -9$$

$$x^2 + 8x + 16 - 10 = 3x + 6 \quad y = 3(0) + 6 = 6$$

$$x^2 + 5x = 0$$

$$x(x + 5) = 0$$

$$x = -5, 0$$

PTS: 2

REF: 061903aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

Algebra II Regents Exam Questions by State Standard: Topic Answer Section

436 ANS: 4

$$y = g(x) = (x-2)^2 \quad (x-2)^2 = 3x-2 \quad y = 3(6)-2 = 16$$

$$x^2 - 4x + 4 = 3x - 2 \quad y = 3(1) - 2 = 1$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, 1$$

PTS: 2 REF: 011705aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

437 ANS: 4

$$y = -(x-1)^2 + 5 \quad 3 + y = 4$$

$$4 - x = -x^2 + 2x - 1 + 5 \quad y = 1$$

$$x^2 - 3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

PTS: 2 REF: 082305aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

438 ANS:

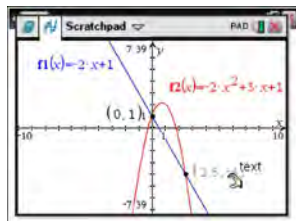
$$x^2 + 8x - 5 = 8x - 4$$

$$x^2 - 1 = 0$$

$$x = \pm 1$$

PTS: 2 REF: 082326aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

439 ANS:



$$-2x + 1 = -2x^2 + 3x + 1$$

$$2x^2 - 5x = 0$$

$$x(2x - 5) = 0$$

$$x = 0, \frac{5}{2}$$

PTS: 2 REF: fall1507aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

440 ANS:

$$2x^2 - 7x + 4 = 11 - 2x \quad y = 11 - 2\left(\frac{7}{2}\right) = 4 \quad \left\{ \left(\frac{7}{2}, 4\right), (-1, 13) \right\}$$

$$2x^2 - 5x - 7 = 0 \quad y = 11 - 2(-1) = 13$$

$$(2x - 7)(x + 1) = 0$$

$$x = \frac{7}{2}, -1$$

PTS: 2 REF: 082232aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

441 ANS: 1

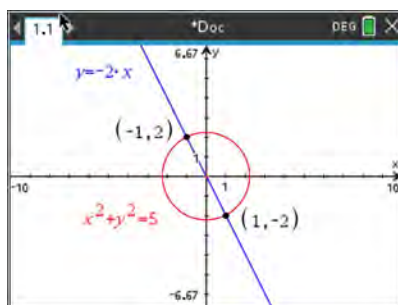
$$(x + 3)^2 + (2x - 4)^2 = 8 \quad b^2 - 4ac$$

$$x^2 + 6x + 9 + 4x^2 - 16x + 16 = 8 \quad 100 - 4(5)(17) < 0$$

$$5x^2 - 10x + 17 = 0$$

PTS: 2 REF: 081719aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

442 ANS: 4



$$x^2 + (-2x)^2 = 5 \quad y = -2(-1) = 2$$

$$5x^2 = 5$$

$$x^2 = 1$$

$$x = \pm 1$$

PTS: 2 REF: 012407aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

443 ANS: 3

$$x^2 + (2x)^2 = 5 \quad y = 2x = \pm 2$$

$$x^2 + 4x^2 = 5$$

$$5x^2 = 5$$

$$x = \pm 1$$

PTS: 2 REF: 081916aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

444 ANS: 2

$$x^2 + (x - 6)^2 = 20 \quad y = 4 - 6 = -2$$

$$x^2 + x^2 - 12x + 36 = 20$$

$$2x^2 - 12x + 16 = 0$$

$$x^2 - 6x + 8 = 0$$

$$(x - 4)(x - 2) = 0$$

PTS: 2 REF: 082516aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

445 ANS:

$$x^2 + (2x - 5)^2 = 25 \quad y + 5 = 2(0) \quad y + 5 = 2(4) \quad (0, -5), (4, 3)$$

$$x^2 + 4x^2 - 20x + 25 = 25 \quad y = -5 \quad y = 3$$

$$5x^2 - 20x = 0$$

$$5x(x - 4) = 0$$

$$x = 0, 4$$

PTS: 4 REF: 062236aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

446 ANS:

$$x^2 + (x - 28)^2 = 400 \quad y = 12 - 28 = -16 \quad y = 16 - 28 = -12$$

$$x^2 + x^2 - 56x + 784 = 400$$

$$2x^2 - 56x + 384 = 0$$

$$x^2 - 28x + 192 = 0$$

$$(x - 16)(x - 12) = 0$$

$$x = 12, 16$$

PTS: 2 REF: 081831aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

447 ANS:

$$(x - 2)^2 + (-2x + 7 - 3)^2 = 20 \quad y = -2(0) + 7 = 7 \quad (0, 7), (4, -1)$$

$$(x - 2)^2 + (-2x + 4)^2 = 20 \quad y = -2(4) + 7 = -1$$

$$x^2 - 4x + 4 + 4x^2 - 16x + 16 = 20$$

$$5x^2 - 20x = 0$$

$$5x(x - 4) = 0$$

$$x = 0, 4$$

PTS: 4 REF: 062335aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

448 ANS:

$$(x-4)^2 + ((x-6)-1)^2 = 9 \quad 7-y=6 \quad 4-y=6 \quad (7,1), (4,-2)$$

$$x^2 - 8x + 16 + x^2 - 14x + 49 - 9 = 0 \quad 1 = y \quad -2 = y$$

$$2x^2 - 22x + 56 = 0$$

$$x^2 - 11x + 28 = 0$$

$$(x-7)(x-4) = 0$$

$$x = 7, 4$$

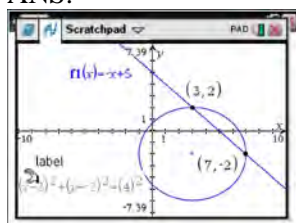
PTS: 4

REF: 082436aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

449 ANS:



$$y = -x + 5 \quad y = -7 + 5 = -2$$

$$(x-3)^2 + (-x+5+2)^2 = 16 \quad y = -3 + 5 = 2$$

$$x^2 - 6x + 9 + x^2 - 14x + 49 = 16$$

$$2x^2 - 20x + 42 = 0$$

$$x^2 - 10x + 21 = 0$$

$$(x-7)(x-3) = 0$$

$$x = 7, 3$$

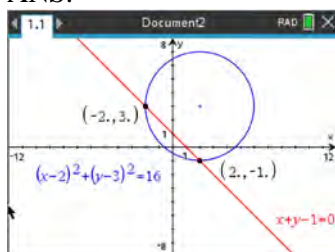
PTS: 4

REF: 061633aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

450 ANS:



$$y = -x + 1 \quad y = -2 + 1 = -1 \quad (2, -1)$$

$$(x-2)^2 + (-x+1-3)^2 = 16 \quad y = 2 + 1 = 3 \quad (-2, 3)$$

$$x^2 - 4x + 4 + x^2 + 4x + 4 = 16$$

$$2x^2 = 8$$

$$x = -2, 2$$

PTS: 4

REF: 012035aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

451 ANS: 3

$$-33t^2 + 360t = 700 + 5t$$

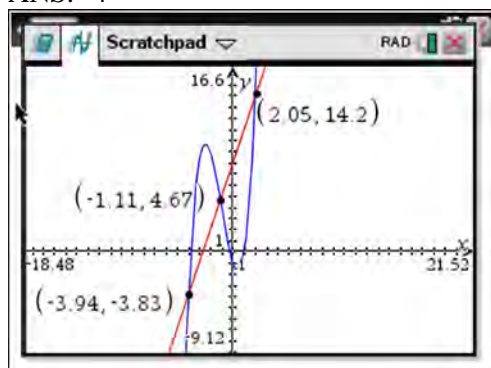
$$-33t^2 + 355t - 700 = 0$$

$$t = \frac{-355 \pm \sqrt{355^2 - 4(-33)(-700)}}{2(-33)} \approx 3,8$$

PTS: 2 REF: 081606aai NAT: A.REI.D.11 TOP: Quadratic-Linear Systems

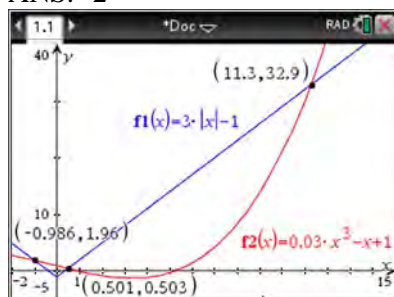
452 ANS: 4 PTS: 2 REF: 061914aai NAT: A.REI.D.11
 TOP: Other Systems KEY: table

453 ANS: 4



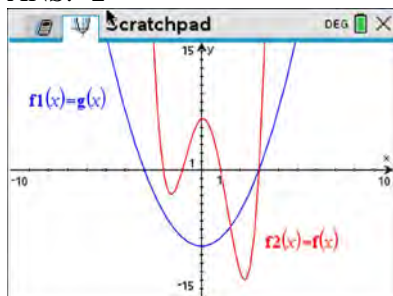
PTS: 2 REF: 061622aai NAT: A.REI.D.11 TOP: Other Systems
 KEY: polynomial

454 ANS: 2



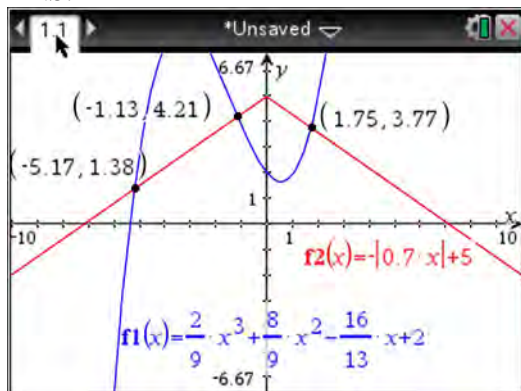
PTS: 2 REF: 061705aai NAT: A.REI.D.11 TOP: Other Systems
 KEY: polynomial

455 ANS: 2



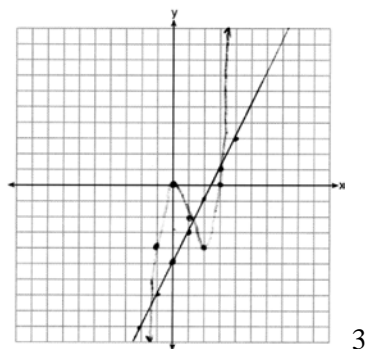
PTS: 2 REF: 082319aai NAT: A.REI.D.11 TOP: Other Systems
 KEY: polynomial

456 ANS:



PTS: 2 REF: fall1510aai NAT: A.REI.D.11 TOP: Other Systems
 KEY: polynomial

457 ANS:



3

PTS: 4 REF: 062233aai NAT: A.REI.D.11 TOP: Other Systems
 KEY: polynomial

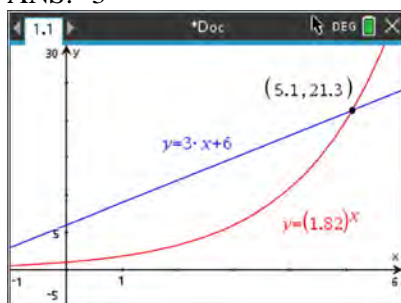
458 ANS: 2



PTS: 2 REF: 081603aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

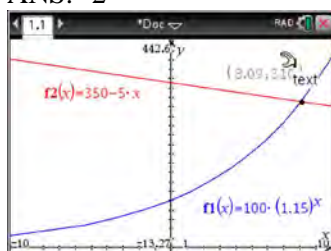
459 ANS: 3



PTS: 2 REF: 012406aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

460 ANS: 2



PTS: 2 REF: 011716aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

461 ANS: 1

$$1240(1.06)^x = 890(1.11)^x$$

$$x \approx 7$$

PTS: 2 REF: 061814aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

462 ANS:

$$A(t) = 4000 \left(1 + \frac{2.4\%}{12} \right)^{12t} \quad B(t) = 3500 \left(1 + \frac{4\%}{4} \right)^{4t} \quad 8.4, \text{ the value of } t \text{ for which } A(t) = B(t)$$

PTS: 4 REF: 012435aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

463 ANS:

$$20e^{.05t} = 30e^{.03t}$$

$$\frac{\frac{2}{3}e^{.05t}}{e^{.05t}} = \frac{e^{.03t}}{e^{.05t}}$$

$$\ln \frac{2}{3} = \ln e^{-.02t}$$

$$\ln \frac{2}{3} = -.02t \ln e$$

$$\frac{\ln \frac{2}{3}}{-.02} = t$$

$$20.3 \approx t$$

PTS: 2 REF: 011829aia NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

464 ANS:

$P(x) = 500(0.97)^x$; 18; The number of palm trees and flamingos will be equal in 18 years.

$$F(x) = 200e^{0.02x}$$

PTS: 4 REF: 062336aia NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

465 ANS:

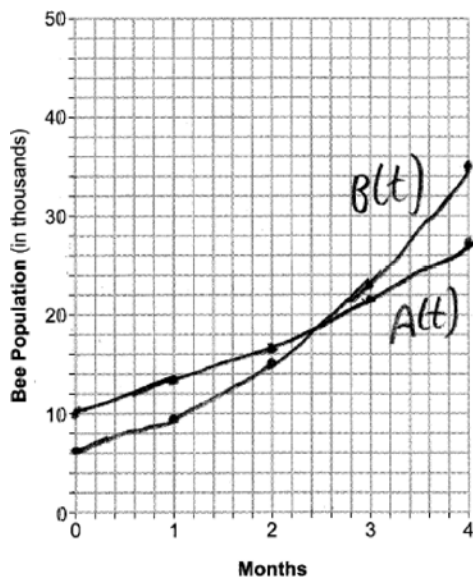
$$T = (400 - 75)e^{-0.0735t} + 75, 325e^{-0.0735(5)} + 75 \approx 300, 270 = (450 - 75)e^{-8r} + 75, 325e^{-0.0735t} + 75 = 375e^{-0.0817t} + 75$$

$$r \approx 0.0817 \qquad t \approx 17$$

PTS: 6 REF: 012337aia NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

466 ANS:



$$A(t) = 10000e^{0.25t}$$

$$B(t) = 6000e^{0.45t}$$

2.6 months for same. $30000 = 10000e^{0.25t}$

$$\ln 3 = \ln e^{0.25t}$$

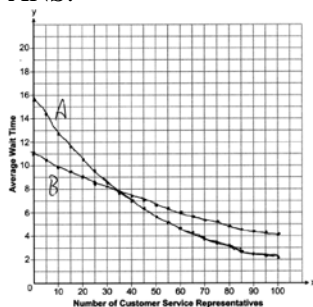
$$\ln 3 = 0.25t \ln e$$

$$\frac{\ln 3}{0.25} = t$$

$$4.4 \approx t$$

PTS: 6 REF: 012537aia NAT: A.REI.D.11 TOP: Other Systems
KEY: exponential

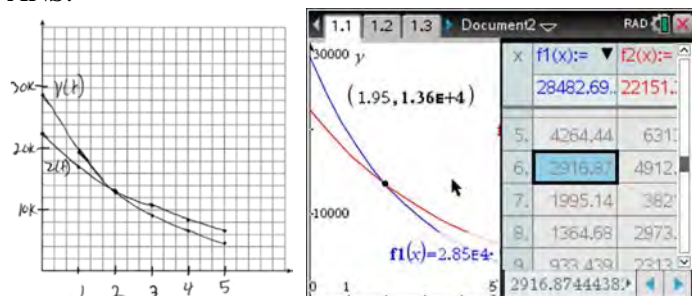
467 ANS:



35; $B(100) - A(100) \approx 2$, which represents the difference of the average wait time when there are 100 CSRs between the plans.

PTS: 6 REF: 082237aia NAT: A.REI.D.11 TOP: Other Systems
KEY: exponential

468 ANS:

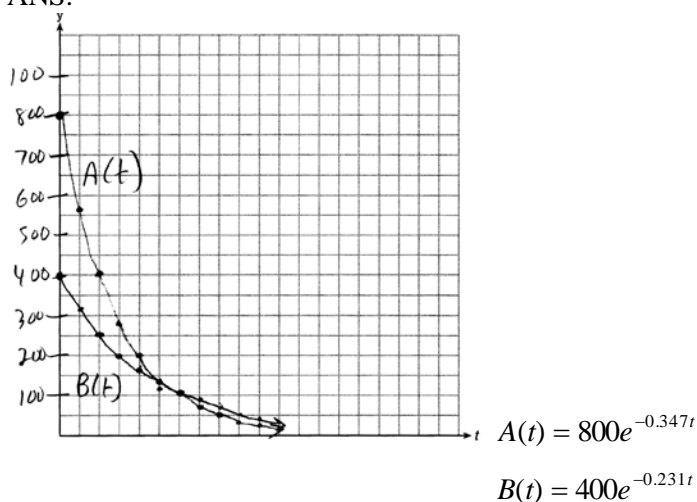


At 1.95 years, the value of the car equals the loan

balance. Zach can cancel the policy after 6 years.

PTS: 4 REF: 081737aai NAT: A.REI.D.11 TOP: Other Systems
KEY: exponential

469 ANS:



$$800e^{-0.347t} = 400e^{-0.231t} \quad 0.15 = e^{-0.347t}$$

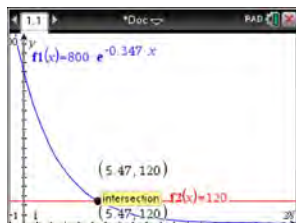
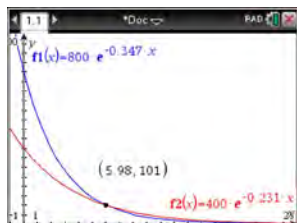
$$\ln 2e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = \ln e^{-0.347t}$$

$$\ln 2 + \ln e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = -0.347t \cdot \ln e$$

$$\ln 2 - 0.347t = -0.231t \quad 5.5 \approx t$$

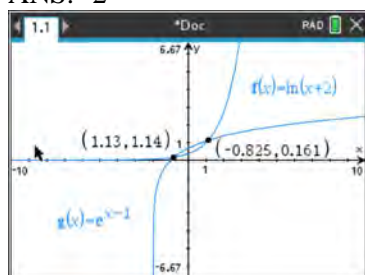
$$\ln 2 = 0.116t$$

$$6 \approx t$$



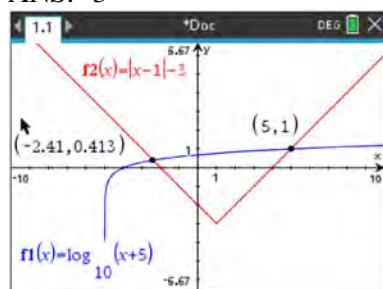
PTS: 6 REF: 061637aai NAT: A.REI.D.11 TOP: Other Systems
KEY: exponential

470 ANS: 2



PTS: 2 REF: 081920aai NAT: A.REI.D.11 TOP: Other Systems
KEY: logarithmic

471 ANS: 3



PTS: 2 REF: 012317aai NAT: A.REI.D.11 TOP: Other Systems
KEY: logarithmic

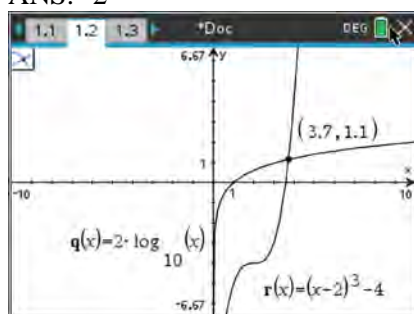
472 ANS: 1 PTS: 2
TOP: Other Systems

REF: 011814aai NAT: A.REI.D.11
KEY: logarithmic

473 ANS: 3 PTS: 2
TOP: Other Systems

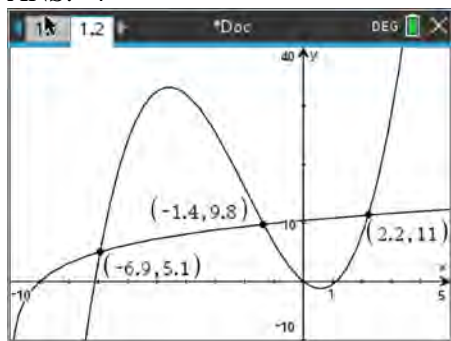
REF: 081819aai NAT: A.REI.D.11
KEY: logarithmic

474 ANS: 2



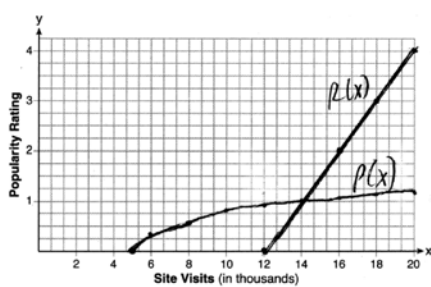
PTS: 2 REF: 082417aai NAT: A.REI.D.11 TOP: Other Systems
KEY: logarithmic

475 ANS: 4



PTS: 2 REF: 082514aia NAT: A.REI.D.11 TOP: Other Systems
KEY: logarithmic

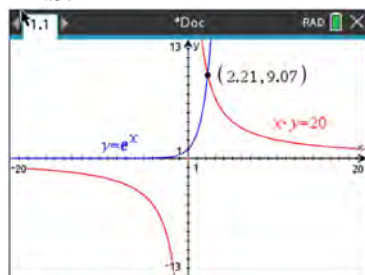
476 ANS:



$P(16) = \log(16 - 4) \approx 1.1$, 14000

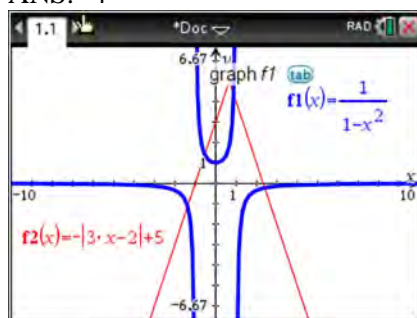
PTS: 6 REF: 061837aia NAT: A.REI.D.11 TOP: Other Systems
KEY: logarithmic

477 ANS: 1



PTS: 2 REF: 082210aia NAT: A.REI.D.11 TOP: Other Systems
KEY: rational

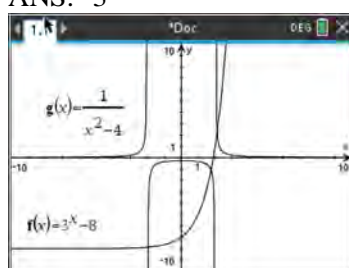
478 ANS: 4



PTS: 2 REF: 011924aia NAT: A.REI.D.11 TOP: Other Systems

KEY: rational

479 ANS: 3



PTS: 2 REF: 062511aia NAT: A.REI.D.11 TOP: Other Systems

KEY: rational

480 ANS: 2

$$2x \left(2x + \frac{5}{2} = \frac{3}{x} \right)$$

$$4x^2 + 5x = 6$$

$$4x^2 + 5x - 6 = 0$$

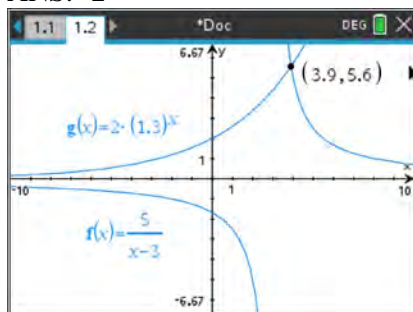
$$(4x - 3)(x + 2) = 0$$

$$x = \frac{3}{4}, -2$$

PTS: 2 REF: 012504aia NAT: A.REI.D.11 TOP: Other Systems

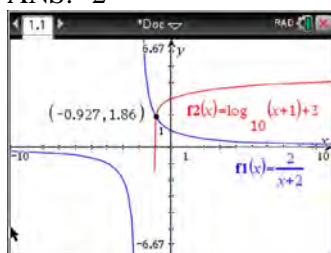
KEY: rational

481 ANS: 2



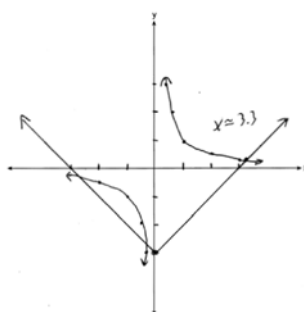
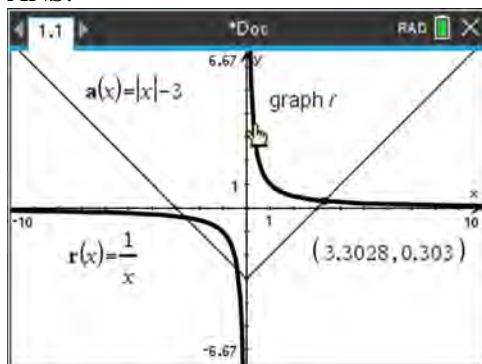
PTS: 2 REF: 062402aai NAT: A.REI.D.11 TOP: Other Systems
KEY: rational

482 ANS: 2



PTS: 2 REF: 011712aai NAT: A.REI.D.11 TOP: Other Systems
KEY: rational

483 ANS:



PTS: 2 REF: 081932aai NAT: A.REI.D.11 TOP: Other Systems
KEY: rational

484 ANS:

$$\text{antibiotic } n(t) = \frac{0+1}{0+5} + \frac{18}{0^2+8(0)+15} = \frac{3}{15} + \frac{18}{15} = \frac{21}{15}$$

$$\frac{t+1}{t+5} + \frac{18}{t^2+8t+15} = \frac{9}{t+3}$$

$$a(0) = \frac{9}{0+3} = 3$$

$$\frac{(t+1)(t+3)}{(t+5)(t+3)} + \frac{18}{(t+3)(t+5)} = \frac{9(t+5)}{(t+3)(t+5)}$$

$$t^2 + 4t + 3 + 18 = 9t + 45$$

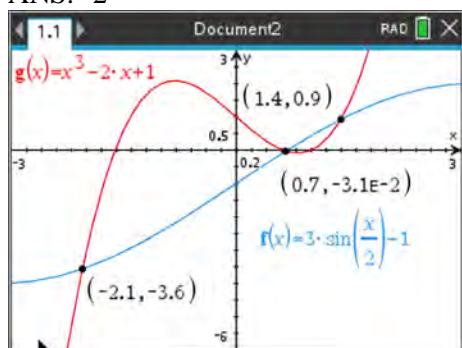
$$t^2 - 5t - 24 = 0$$

$$(t-8)(t+3) = 0$$

$$t = 8$$

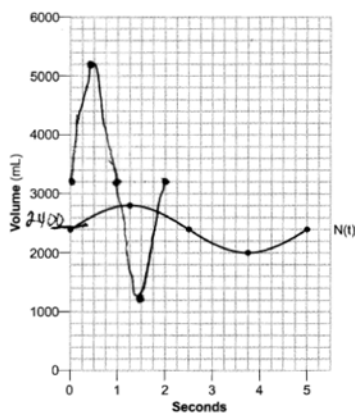
PTS: 6 REF: 012037aia NAT: A.REI.D.11 TOP: Other Systems
KEY: rational

485 ANS: 2



PTS: 2 REF: 012021aia NAT: A.REI.D.11 TOP: Other Systems
KEY: trigonometric

486 ANS:



$$N(t) = 400 \sin\left(\frac{2\pi}{5} t\right) + 2400.$$

4 times.

PTS: 6 REF: 062337aia NAT: A.REI.D.11 TOP: Other Systems
KEY: trigonometric

487 ANS: 3

$$x^2 - 6x + 9 - (x^2 + 6x + 9) = -12x$$

PTS: 2 REF: 062210aai NAT: F.BF.A.1 TOP: Operations with Functions

488 ANS: 2

$$3x^2 - 7x + 25 - (7x^2 - 10x + 22) = -4x^2 + 3x + 3$$

PTS: 2 REF: 012513aai NAT: F.BF.A.1 TOP: Operations with Functions

489 ANS: 4

TOP: Operations with Functions

PTS: 2

REF: 081803aai

NAT: F.BF.A.1

490 ANS: 4

$$\frac{m(c)}{g(c)} = \frac{c+1}{1-c^2} = \frac{c+1}{(1+c)(1-c)} = \frac{1}{1-c}$$

PTS: 2 REF: 061608aai NAT: F.BF.A.1 TOP: Operations with Functions

491 ANS: 3

TOP: Operations with Functions

PTS: 2

REF: 011710aai

NAT: F.BF.A.1

492 ANS: 2

$$\frac{12x^{8a}}{3x^{2a}}$$

PTS: 2 REF: 082502aai NAT: F.BF.A.1 TOP: Operations with Functions

493 ANS: 1

$$\frac{f(x)}{g(x)} = \frac{2x^2 + 7x - 15}{3 - 2x} = \frac{(2x - 3)(x + 5)}{-(2x - 3)} = \frac{x + 5}{-1} = -x - 5$$

PTS: 2 REF: 012412aai NAT: F.BF.A.1 TOP: Operations with Functions

494 ANS: 2

$$V(x) = x(18 - 2x)(18 - 2x) = x(324 - 72x + 4x^2) = 324x - 72x^2 + 4x^3$$

PTS: 2 REF: 082418aai NAT: F.BF.A.1 TOP: Operations with Functions

495 ANS: 3

TOP: Operations with Functions

PTS: 2

REF: 012002aai

NAT: F.BF.A.1

496 ANS: 3

$$95.4x - 6x^2 - (0.18x^3 + 0.02x^2 + 4x + 180)$$

PTS: 2 REF: 082322aai NAT: F.BF.A.1 TOP: Operations with Functions

497 ANS: 2

$$\begin{aligned} x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) &= 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120 \\ &= -0.15x^3 - 0.02x^2 + 28x - 120 \end{aligned}$$

PTS: 2 REF: 061709aai NAT: F.BF.A.1 TOP: Operations with Functions

498 ANS: 1

$$p(x) = r(x) - c(x)$$

$$-0.5x^2 + 250x - 300 = -0.3x^2 + 150x - c(x)$$

$$c(x) = 0.2x^2 - 100x + 300$$

PTS: 2 REF: 061813aai NAT: F.BF.A.1 TOP: Operations with Functions

499 ANS: 3

$$p(x) = r(x) - c(x)$$

$$-15x^2 + 600x + 60 = -0.4x^2 + 130x + 1200 - c(x)$$

$$c(x) = 14.6x^2 - 470x + 1140$$

PTS: 2 REF: 062421aai NAT: F.BF.A.1 TOP: Operations with Functions

500 ANS:

$$(2x^2 + x - 3) \cdot (x - 1) - \left[(2x^2 + x - 3) + (x - 1) \right]$$

$$(2x^3 - 2x^2 + x^2 - x - 3x + 3) - (2x^2 + 2x - 4)$$

$$2x^3 - 3x^2 - 6x + 7$$

PTS: 4 REF: 011833aai NAT: F.BF.A.1 TOP: Operations with Functions

501 ANS:

$$(x^3 + 2x - 1)(x^2 + 7) - 3(x^4 - 5x)$$

$$x^5 + 7x^3 + 2x^3 + 14x - x^2 - 7 - 3x^4 + 15x$$

$$x^5 - 3x^4 + 9x^3 - x^2 + 29x - 7$$

PTS: 2 REF: 012330aai NAT: F.BF.A.1 TOP: Operations with Functions

502 ANS:

$$(3x^2 - 4x + 7)(x - 2) - (x - 2)^3$$

$$3x^3 - 6x^2 - 4x^2 + 8x + 7x - 14 - (x^3 - 6x^2 + 12x - 8)$$

$$3x^3 - 10x^2 + 15x - 14 - x^3 + 6x^2 - 12x + 8$$

$$2x^3 - 4x^2 + 3x - 6$$

PTS: 4 REF: 062535aai NAT: F.BF.A.1 TOP: Operations with Functions

503 ANS:

$$4(2x - 1) - (5(x + 1)^2 + 3(x + 1) - 12)$$

$$8x - 4 - (5(x^2 + 2x + 1) + 3x + 3 - 12)$$

$$8x - 4 - (5x^2 + 10x + 5 + 3x - 9)$$

$$8x - 4 - (5x^2 + 13x - 4)$$

$$-5x^2 - 5x$$

PTS: 4 REF: 082536aai NAT: F.BF.A.1 TOP: Operations with Functions

504 ANS: 1 PTS: 2 REF: 081903aai NAT: F.LE.A.2

TOP: Families of Functions

505 ANS: 3 PTS: 2 REF: 061906aai NAT: F.LE.A.2

TOP: Families of Functions

506 ANS: 1

2) linear, 3) quadratic, 4) cubic

PTS: 2 REF: 061920aai NAT: F.LE.A.2 TOP: Families of Functions

507 ANS: 4 PTS: 2 REF: 082515aai NAT: F.BF.B.3

TOP: Transformations with Functions

508 ANS: 3 PTS: 2 REF: 062205aai NAT: F.BF.B.3

TOP: Transformations with Functions

509 ANS: 4 PTS: 2 REF: 081817aai NAT: F.BF.B.3

TOP: Transformations with Functions

510 ANS: 4

I. Minimum does not change, only period; II. $-16 + 8 = -8$; III. $\frac{1}{2}(-16) = -8$

PTS: 2 REF: 012523aai NAT: F.BF.B.3 TOP: Transformations with Functions

511 ANS: 4

 $(2 + 4, -3 + 1)$

PTS: 2 REF: 062518aai NAT: F.BF.B.3 TOP: Transformations with Functions

512 ANS:

$$f(x) = x^2(x + 4)(x - 3); g(x) = (x + 2)^2(x + 6)(x - 1)$$

PTS: 4 REF: 011836aai NAT: F.BF.B.3 TOP: Transformations with Functions

513 ANS: 3

$f(x) = -f(x)$, so $f(x)$ is odd. $g(-x) \neq g(x)$, so $g(x)$ is not even. $g(-x) \neq -g(x)$, so $g(x)$ is not odd. $h(-x) = h(x)$, so $h(x)$ is even.

PTS: 2 REF: fall1502aai NAT: F.BF.B.3 TOP: Even and Odd Functions

KEY: graphically

514 ANS: 2

$$f(x) = f(-x)$$

$$x^2 - 4 = (-x)^2 - 4$$

$$x^2 - 4 = x^2 - 4$$

PTS: 2

REF: 061806aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

515 ANS: 2

$$f(x) = f(-x)$$

$$x^2 + 1 = (-x)^2 + 1$$

$$x^2 + 1 = x^2 + 1$$

PTS: 2

REF: 082323aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

516 ANS: 1

The graph of $y = \sin x$ is unchanged when rotated 180° about the origin.

PTS: 2

REF: 081614aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

517 ANS: 2

PTS: 2

REF: 081911aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

518 ANS: 1

PTS: 2

REF: 062318aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

519 ANS:

No, because a 180° rotation of f about the origin does not map f onto itself.

PTS: 2

REF: 062432aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

520 ANS: 2

$$x = -6(y - 2)$$

$$-\frac{x}{6} = y - 2$$

$$-\frac{x}{6} + 2 = y$$

PTS: 2

REF: 011821aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

521 ANS: 2

$$y = \frac{1}{2}x + 8 \quad x = \frac{1}{2}y + 8$$

$$2x = y + 16$$

$$y = 2x - 16$$

PTS: 2

REF: 081806aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

522 ANS: 2

$$x = 4y + 5$$

$$x - 5 = 4y$$

$$\frac{1}{4}x - \frac{5}{4} = y$$

PTS: 2

REF: 061909aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

523 ANS: 3

$$y = -6x + \frac{1}{2}$$

$$x = -6y + \frac{1}{2}$$

$$x - \frac{1}{2} = -6y$$

$$-\frac{1}{6}\left(x - \frac{1}{2}\right) = y$$

PTS: 2

REF: 062217aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

524 ANS: 3

$$x = \frac{1}{2}y + 2$$

$$2x = y + 4$$

$$y = 2x - 4$$

PTS: 2

REF: 012315aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

525 ANS: 3
 $x = 12y - 4$

$$x + 4 = 12y$$

$$\frac{x+4}{12} = y$$

PTS: 2

REF: 082304aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

526 ANS: 3
 $x = 2y + 6$

$$x - 6 = 2y$$

$$\frac{x}{2} - 3 = y$$

PTS: 2

REF: 082503aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

527 ANS: 2
 $x = -\frac{3}{4}y + 2$

$$-4x = 3y - 8$$

$$-4x + 8 = 3y$$

$$-\frac{4}{3}x + \frac{8}{3} = y$$

PTS: 2

REF: 061616aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

528 ANS: 3
 $x = \frac{2}{3}y + \frac{1}{6}$

$$6x = 4y + 1$$

$$4y = 6x - 1$$

$$y = \frac{6}{4}x - \frac{1}{4}$$

PTS: 2

REF: 062321aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

529 ANS: 3

$$x = -\frac{2y}{5} + 4 \quad y = -\frac{5}{2}(6) + 10 = -5$$

$$5x = -2y + 20$$

$$2y = -5x + 20$$

$$y = -\frac{5}{2}x + 10$$

PTS: 2

REF: 082223aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

530 ANS:

$$y = \frac{2}{3}x + 6$$

$$x = \frac{2}{3}y + 6$$

$$3x = 2y + 18$$

$$3x - 18 = 2y$$

$$\frac{3}{2}x - 9 = y = f^{-1}(x)$$

PTS: 2

REF: 062530aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

531 ANS: 3

$$y = x^3 - 2$$

$$x = y^3 - 2$$

$$x + 2 = y^3$$

$$\sqrt[3]{x+2} = y$$

PTS: 2

REF: 061815aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

532 ANS: 2

$$y = x^3 - 3$$

$$x = y^3 - 3$$

$$x + 3 = y^3$$

$$\sqrt[3]{x+3} = y$$

PTS: 2

REF: 012419aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

533 ANS: 4

$$y = \sqrt[3]{x+2}$$

$$x = \sqrt[3]{y+2}$$

$$x^3 = y+2$$

$$y = x^3 - 2$$

PTS: 2

REF: 062419aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

534 ANS: 2

$$y = \sqrt[3]{x} + 4$$

$$x = \sqrt[3]{y} + 4$$

$$x - 4 = \sqrt[3]{y}$$

$$(x - 4)^3 = y$$

PTS: 2

REF: 012519aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

535 ANS:

$$x = (y - 3)^3 + 1$$

$$x - 1 = (y - 3)^3$$

$$\sqrt[3]{x - 1} = y - 3$$

$$\sqrt[3]{x - 1} + 3 = y$$

$$f^{-1}(x) = \sqrt[3]{x - 1} + 3$$

PTS: 2

REF: fall1509aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

536 ANS: 2

$$x = \frac{y+1}{y-2}$$

$$xy - 2x = y + 1$$

$$xy - y = 2x + 1$$

$$y(x - 1) = 2x + 1$$

$$y = \frac{2x+1}{x-1}$$

PTS: 2

REF: 081714aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: rational

537 ANS: 2

$$x = \frac{y}{y+2}$$

$$xy + 2x = y$$

$$xy - y = -2x$$

$$y(x-1) = -2x$$

$$y = \frac{-2x}{x-1}$$

PTS: 2 REF: 081924aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: rational

538 ANS: 4

$$f(0) = 4 \sin(2(0)) = 0; g(0) = 3(0)^4 + 2(0)^3 + 7 = 7; h(0) = 5e^{2(0)} + 3 = 8; j(0) = 6 \log_2(3(0) + 4) = 12$$

PTS: 2 REF: 082310aai NAT: F.IF.C.9 TOP: Comparing Functions

539 ANS: 4

The maximum of p is 5. The minimum of f is $-\frac{21}{4}$ ($x = \frac{-6}{2(4)} = -\frac{3}{4}$)

$$f\left(-\frac{3}{4}\right) = 4\left(-\frac{3}{4}\right)^2 + 6\left(-\frac{3}{4}\right) - 3 = 4\left(\frac{9}{16}\right) - \frac{18}{4} - \frac{12}{4} = -\frac{21}{4}. \quad \frac{20}{4} - \left(-\frac{21}{4}\right) = \frac{41}{4} = 10.25$$

PTS: 2 REF: 011922aai NAT: F.IF.C.9 TOP: Comparing Functions

540 ANS: 1

x -intercept: $f(x) = (x-2)^2(x+3) = 0$, $g(x) = 0$ at $x = 2, -3$;

$$x = 2, -3$$

y -intercept: $f(0) = (0-2)^2(0+3) = (0-2)^2(0+3) = 12$, $g(0) = -6$

PTS: 2 REF: 062510aai NAT: F.IF.C.9 TOP: Comparing Functions

541 ANS: 1

PTS: 2

REF: 081804aai

NAT: F.IF.C.9

TOP: Comparing Functions

542 ANS: 4

PTS: 2

REF: 062309aai

NAT: F.IF.C.9

TOP: Comparing Functions

543 ANS:

$0 = \log_{10}(x-4)$ The x -intercept of h is $(2,0)$. f has the larger value.

$$10^0 = x - 4$$

$$1 = x - 4$$

$$x = 5$$

PTS: 2 REF: 081630aai NAT: F.IF.C.9 TOP: Comparing Functions

544 ANS:

q has the smaller minimum value for the domain $[-2, 2]$. h 's minimum is $-1(2(-1) + 1)$ and q 's minimum is -8 .

PTS: 2 REF: 011830aai NAT: F.IF.C.9 TOP: Comparing Functions

545 ANS: 2

$h(x)$ does not have a y -intercept.

PTS: 2 REF: 011719aai NAT: F.IF.C.9 TOP: Comparing Functions

546 ANS: 2

PTS: 2 REF: 062222aai NAT: F.IF.C.9
TOP: Comparing Functions

547 ANS: 1

$$\frac{-12}{16} = \frac{9}{-12} = \frac{-6.75}{9}$$

PTS: 2 REF: 012017aai NAT: F.IF.A.3 TOP: Sequences

KEY: difference or ratio

548 ANS: 1

$$\frac{-\frac{1}{8}a}{-\frac{1}{4}a} = \frac{-\frac{1}{16}a}{-\frac{1}{8}a} = \frac{1}{2}$$

PTS: 2 REF: 062507aai NAT: F.IF.A.3 TOP: Sequences

KEY: difference or ratio

549 ANS: 3

PTS: 2 REF: 061910aai NAT: F.IF.A.3
TOP: Sequences KEY: difference or ratio

550 ANS: 2

$$a_2 = 8 + \log_{2+1} 1 = 8 + 0 = 8$$

$$a_3 = 8 + \log_{3+1} 2 = 8 + \frac{1}{2} = 8.5$$

PTS: 2 REF: 062221aai NAT: F.IF.A.3 TOP: Sequences

KEY: recursive

551 ANS:

$a_1 = 3$ $a_2 = 7$ $a_3 = 15$ $a_4 = 31$; No, because there is no common ratio: $\frac{7}{3} \neq \frac{15}{7}$

PTS: 2 REF: 061830aai NAT: F.IF.A.3 TOP: Sequences

KEY: recursive

552 ANS: 1

$$a_7 = -2(-3)^{7-1} = -1458$$

PTS: 2 REF: 082501aai NAT: F.BF.A.2 TOP: Sequences

KEY: explicit

553 ANS: 3

$$r = \frac{-2\sqrt{3}}{\sqrt{6}} = \frac{-2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{-2\sqrt{2}}{2} = -\sqrt{2} \quad a_7 = \sqrt{6}(-\sqrt{2})^{7-1} = \sqrt{6}(-\sqrt{2})^6 = \sqrt{6} \cdot 2^3 = 8\sqrt{6}$$

PTS: 2 REF: 012410aai NAT: F.BF.A.2 TOP: Sequences

KEY: explicit

554 ANS: 1

$$d = 18; r = \pm \frac{5}{4}$$

PTS: 2 REF: 011714aai NAT: F.BF.A.2 TOP: Sequences

KEY: explicit

555 ANS: 2

$$121(b)^2 = 64 \quad 64 \left(\frac{8}{11} \right)^2 \approx 34$$

$$b = \frac{8}{11}$$

PTS: 2 REF: 011904aai NAT: F.BF.A.2 TOP: Sequences

KEY: explicit

556 ANS:

$$\frac{6.25 - 2.25}{21 - 5} = \frac{4}{16} = \$.25 \text{ fine per day. } 2.25 - 5(.25) = \$1 \text{ replacement fee. } a_n = 1.25 + (n - 1)(.25). \quad a_{60} = \$16$$

PTS: 4 REF: 081734aai NAT: F.BF.A.2 TOP: Sequences

KEY: explicit

557 ANS: 4

$$a_1 = 2.5 + 0.5(1) = 3$$

PTS: 2 REF: 011916aai NAT: F.BF.A.2 TOP: Sequences

KEY: recursive, arithmetic

558 ANS: 3

PTS: 2

REF: 011824aai

NAT: F.BF.A.2

TOP: Sequences KEY: recursive, arithmetic

559 ANS:

$$a_1 = 12$$

$$a_n = a_{n-1} + 6$$

PTS: 2 REF: 012430aai NAT: F.BF.A.2 TOP: Sequences

KEY: recursive, arithmetic

560 ANS:

Jillian's plan, because distance increases by one mile each week. $a_1 = 10$ $a_n = n + 12$

$$a_n = a_{n-1} + 1$$

PTS: 4 REF: 011734aai NAT: F.BF.A.2 TOP: Sequences

KEY: recursive, arithmetic

- 561 ANS: 1
(2) is not recursive
- PTS: 2 REF: 081608aai NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric
- 562 ANS: 4
(1) and (3) are not recursive
- PTS: 2 REF: 012013aai NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric
- 563 ANS: 4
1) is a correct formula, but not recursive
- PTS: 2 REF: 082216aai NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric
- 564 ANS: 3 PTS: 2 REF: 081618aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 565 ANS: 3 PTS: 2 REF: 062513aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 566 ANS: 4 PTS: 2 REF: 062412aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 567 ANS: 3 PTS: 2 REF: 061623aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 568 ANS: 3 PTS: 2 REF: 081909aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 569 ANS: 4 PTS: 2 REF: 081624aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 570 ANS: 4 PTS: 2 REF: 081810aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 571 ANS: 4 PTS: 2 REF: 082518aai NAT: F.BF.A.2
TOP: Sequences KEY: recursive, geometric
- 572 ANS: 4
The scenario represents a decreasing geometric sequence with a common ratio of 0.80.
- PTS: 2 REF: 061610aai NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric
- 573 ANS:
 $a_1 = 4$
 $a_n = 3a_{n-1}$
- PTS: 2 REF: 081931aai NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

574 ANS:

$$\frac{9}{6} = 1.5 \quad a_1 = 6$$

$$a_n = 1.5 \cdot a_{n-1}$$

PTS: 2 REF: 061931aii NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

575 ANS:

$$\frac{20}{8} = 2.5 \quad a_1 = 8$$

$$a_n = 2.5 \cdot a_{n-1}$$

PTS: 2 REF: 012531aii NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

576 ANS:

$$\frac{63}{189} = \frac{1}{3} \quad a_1 = 189$$

$$a_n = \frac{1}{3} a_{n-1}$$

PTS: 2 REF: 062329aii NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

577 ANS:

$$a_n = x^{n-1}(x+1) \quad x^{n-1} = 0 \quad x+1 = 0$$

$$x = 0 \quad x = -1$$

PTS: 4 REF: spr1511aii NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

578 ANS:

$$1.5\%; \quad P(t) = 92.2(1.015)^t; \quad \frac{300}{92.2} = (1.015)^t$$

$$\log \frac{300}{92.2} = t \log(1.015)$$

$$\frac{\log \frac{300}{92.2}}{\log(1.015)} = t$$

$$t \approx 79$$

PTS: 6 REF: 062237aii NAT: F.BF.A.2 TOP: Sequences
KEY: recursive, geometric

579 ANS: 1 PTS: 2 REF: 081609aii NAT: F.BF.B.6
TOP: Sigma Notation KEY: represent

580 ANS: 1 PTS: 2 REF: 082221aii NAT: F.BF.B.6
TOP: Sigma Notation KEY: represent

581 ANS: 1 PTS: 2 REF: 081813aai NAT: F.BF.B.7
TOP: Series KEY: geometric

582 ANS: 4 PTS: 2 REF: 012423aai NAT: F.BF.B.7
TOP: Series KEY: geometric

583 ANS: 2 PTS: 2 REF: 062324aai NAT: F.BF.B.7
TOP: Series KEY: geometric

584 ANS: 2 PTS: 2 REF: 061724aai NAT: F.BF.B.7
TOP: Series KEY: geometric

585 ANS: 3
$$S_{20} = \frac{-2 - (-2)(-3)^{20}}{1 - (-3)} = 1,743,392,200$$

PTS: 2 REF: 012306aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

586 ANS: 3
$$8r^3 = 216 \quad S_{12} = \frac{8 - 8(3)^{12}}{1 - 3} = 2125760$$

$$r^3 = 27$$

$$r = 3$$

PTS: 2 REF: 081902aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

587 ANS: 4
$$S_n = \frac{32 - 32(.8)^{12}}{1 - .8} \approx 149$$

PTS: 2 REF: 081721aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

588 ANS: 4
$$S_{15} = \frac{10 - 10(1.09)^{15}}{1 - 1.09} \approx 293.609$$

PTS: 2 REF: 062424aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

589 ANS: 4
$$S_5 = \frac{350 - 350(1.15)^5}{1 - 1.15} \approx 2360$$

PTS: 2 REF: 012524aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

590 ANS: 4

$$S_7 = \frac{85000 - 85000(1.06)^7}{1 - 1.06} \approx 713476.20$$

PTS: 2 REF: 061905aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

591 ANS: 4

$$S_{10} = \frac{90000 - 90000(1.02)^{10}}{1 - 1.02} \approx 985,475$$

PTS: 2 REF: 082424aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

592 ANS: 2

$$S_{20} = \frac{.01 - .01(3)^{20}}{1 - 3} = 17,433,922$$

PTS: 2 REF: 011822aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

593 ANS:

$$r = \frac{360}{300} = 1.2 \quad S_n = \frac{300 - 300(1.2)^n}{1 - 1.2} \quad S_{10} = \frac{300 - 300(1.2)^{10}}{1 - 1.2} \approx 7787.6$$

PTS: 2 REF: 012029aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

594 ANS:

$$S_5 = \frac{6 - 6(.8)^5}{1 - .8} \approx 20.17$$

PTS: 2 REF: 062226aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

595 ANS:

$$S_{10} = \frac{15 - 15(1.03)^{10}}{1 - 1.03} \approx 171.958$$

PTS: 2 REF: 011929aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

596 ANS:

$$a_n = 100(.8)^{n-1} \quad S_{20} = \frac{100 - 100(.8)^{20}}{1 - .8} \approx 494 \text{ No, because } 494 > 40 \times 12.$$

PTS: 4 REF: 012033aai NAT: F.BF.B.7 TOP: Series
KEY: geometric

597 ANS:

$$S_{30} = \frac{42000 - 42000(1.03)^{30}}{1 - 1.03} \approx 1,998,000$$

PTS: 2 REF: 082531aii NAT: F.BF.B.7 TOP: Series
KEY: geometric

598 ANS:

$$S_n = \frac{33000 - 33000(1.04)^n}{1 - 1.04} \quad S_{15} = \frac{33000 - 33000(1.04)^{15}}{1 - 1.04} \approx 660778.39$$

PTS: 4 REF: 061634aii NAT: F.BF.B.7 TOP: Series
KEY: geometric

599 ANS:

$$C_n = \frac{85000 - 85000(1.025)^n}{1 - 1.025} \quad C_{10} = \frac{85000 - 85000(1.025)^{10}}{1 - 1.025} \approx 952300$$

PTS: 4 REF: 062536aii NAT: F.BF.B.7 TOP: Series
KEY: geometric

600 ANS: 1 PTS: 2 REF: 081616aii NAT: F.TF.A.1
TOP: Unit Circle KEY: bimodalgraph

601 ANS: 2 PTS: 2 REF: 062219aii NAT: F.TF.A.1
TOP: Unit Circle

602 ANS: 4 PTS: 2 REF: 082205aii NAT: F.TF.A.2
TOP: Unit Circle

603 ANS:

$$t^2 + \left(\frac{4}{7}\right)^2 = 1 \quad -\frac{\sqrt{33}}{7}$$

$$t^2 + \frac{16}{49} = \frac{49}{49}$$

$$t^2 = \frac{33}{49}$$

$$t = \frac{\pm\sqrt{33}}{7}$$

PTS: 2 REF: 011931aii NAT: F.TF.A.2 TOP: Unit Circle
604 ANS: 1 PTS: 2 REF: 011815aii NAT: F.TF.A.2
TOP: Unit Circle

605 ANS:

$\csc \theta = \frac{1}{\sin \theta}$, and $\sin \theta$ on a unit circle represents the y value of a point on the unit circle. Since $y = \sin \theta$,

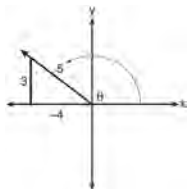
$$\csc \theta = \frac{1}{y}.$$

PTS: 2 REF: 011727aii NAT: F.TF.A.2 TOP: Reciprocal Trigonometric Relationships

606 ANS: 4 PTS: 2 REF: 081707aii NAT: F.TF.A.2
TOP: Reference Angles KEY: bimodalgraph

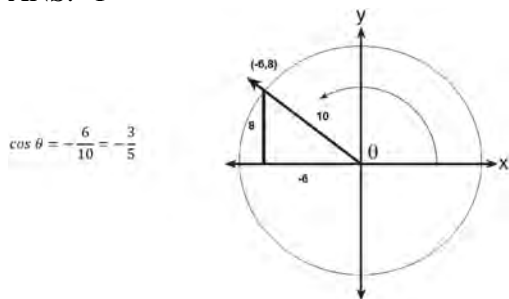
607 ANS: 1

A reference triangle can be sketched using the coordinates $(-4, 3)$ in the second quadrant to find the value of $\sin \theta$.



PTS: 2 REF: spr1503aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

608 ANS: 1



PTS: 2 REF: 061617aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

609 ANS: 2

$$\sqrt{(-2)^2 + (-3)^2} = \sqrt{13}; \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-3}{-2} = \frac{3}{2}$$

PTS: 2 REF: 062304aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

610 ANS: 4 PTS: 2 REF: 012501aii NAT: F.TF.A.2
TOP: Determining Trigonometric Functions KEY: radians

611 ANS: 1 PTS: 2 REF: 062514aii NAT: F.TF.A.2
TOP: Determining Trigonometric Functions KEY: radians

612 ANS: 4

Since the terminal side of θ passes through $(-3, -4)$, $\cos \theta < 0$ and $\sin \theta < 0$. $\cos \theta < 0 \rightarrow \sec \theta < 0$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \rightarrow \frac{-}{-} = +$$

PTS: 2 REF: 082420aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

613 ANS:

$$\frac{-1}{\sqrt{2^2 + (-1)^2}} = -\frac{1}{\sqrt{5}}$$

PTS: 2 REF: 061832aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

614 ANS: 2

$$\text{If } \cos \theta = \frac{7}{25}, \sin \theta = \pm \frac{24}{25}, \text{ and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\pm \frac{24}{25}}{\frac{7}{25}} = \pm \frac{24}{7}$$

PTS: 2 REF: 081811aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

615 ANS: 1

$$\text{If } \sin \theta = \frac{7}{25}, \cos \theta = -\frac{24}{25} \text{ in QII, and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{7}{25}}{-\frac{24}{25}} = -\frac{7}{24}$$

PTS: 2 REF: 062417aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

616 ANS: 1

$$-\sqrt{1 - \left(-\frac{3}{4}\right)^2} = -\sqrt{\frac{16}{16} - \frac{9}{16}} = -\sqrt{\frac{7}{16}} = -\frac{\sqrt{7}}{4}$$

PTS: 2 REF: 081905aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

617 ANS: 2

$$\cos \theta = \pm \sqrt{1 - \left(\frac{-\sqrt{2}}{5}\right)^2} = \pm \sqrt{\frac{25}{25} - \frac{2}{25}} = \pm \frac{\sqrt{23}}{5}$$

PTS: 2 REF: 061712aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

618 ANS: 3

$$\sin^2 A + \left(\frac{\sqrt{5}}{3}\right)^2 = 1 \quad \text{Since } \tan A < 0, \sin A = -\frac{2}{3}$$

$$\sin^2 A + \frac{5}{9} = \frac{9}{9}$$

$$\sin^2 A = \frac{4}{9}$$

$$\sin A = \pm \frac{2}{3}$$

PTS: 2 REF: 012320aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

619 ANS: 3

$$\frac{-2}{\sqrt{5^2 - 2^2}} = \frac{-2}{\sqrt{21}}$$

PTS: 2 REF: 082312aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

620 ANS: 1

$$\cos \theta = -\frac{3}{5}; \sec \theta = -\frac{5}{3}$$

PTS: 2 REF: 012421aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

621 ANS:

$$\sin^2 \theta + (-0.7)^2 = 1 \quad \text{Since } \theta \text{ is in Quadrant II, } \sin \theta = \sqrt{.51} \text{ and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\sqrt{.51}}{-0.7} \approx -1.02$$

$$\sin^2 \theta = .51$$

$$\sin \theta = \pm \sqrt{.51}$$

PTS: 2 REF: 081628aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

622 ANS:

$$\left(-\frac{2}{7}\right)^2 + \sin^2 \theta = 1 \quad \frac{3\sqrt{5}}{7} \text{ as sin is positive in Quadrant II.}$$

$$\frac{4}{49} + \sin^2 \theta = \frac{49}{49}$$

$$\sin^2 \theta = \frac{45}{49}$$

$$\sin \theta = \pm \frac{3\sqrt{5}}{7}$$

PTS: 2 REF: 012527aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

623 ANS:

$$\left(-\frac{\sqrt{10}}{10}\right)^2 + \sin^2 \theta = 1 \qquad -\frac{3\sqrt{10}}{10} \text{ as sin is negative in Quadrant III.}$$

$$\frac{10}{100} + \sin^2 \theta = \frac{100}{100}$$

$$\sin^2 \theta = \frac{90}{100}$$

$$\sin \theta = \pm \frac{3}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = \pm \frac{3\sqrt{10}}{10}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-3\sqrt{10}/10}{-\sqrt{10}/10} = 3$$

PTS: 2

REF: 082529aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

624 ANS:

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-7/25}{-24/25} \quad \cos \theta = \frac{-24}{25}$$

PTS: 2

REF: 061928aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

625 ANS:

$$\cot A = \frac{\cos A}{\sin A}$$

$$-3 = \frac{3}{\sin A}$$

$$\sin A = \frac{3}{-3\sqrt{10}} = -\frac{1}{\sqrt{10}}$$

PTS: 2

REF: 082229aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

626 ANS:

$\pi < \theta < 2\pi \rightarrow$ Quadrant III or IV θ must be in Quadrant IV, where $\tan \theta$ is negative.

$$\cos \theta = \frac{\sqrt{3}}{4} \rightarrow \text{Quadrant I or IV}$$

PTS: 2

REF: 012332aai

NAT: F.TF.C.8

TOP: Finding the Terminal Side of an Angle

627 ANS: 1

PTS: 2

REF: 011704aai

NAT: F.TF.C.8

TOP: Proving Trigonometric Identities

KEY: basic

628 ANS: 1

$$-4(-1) - 3 = 1 \quad 8 = \frac{2\pi}{b}$$

$$b = \frac{\pi}{4}$$

PTS: 2

REF: 081820aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

629 ANS: 4

$$\text{period} = \frac{2\pi}{B}$$

$$\frac{1}{60} = \frac{2\pi}{B}$$

$$B = 120\pi$$

PTS: 2

REF: 061624aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

630 ANS: 1

PTS: 2

REF: 061708aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

631 ANS: 1

The cosine function has been translated +3. Since the maximum is 5 and the minimum is 1, the amplitude is 2.

$$\frac{\pi}{3} = \frac{2\pi}{b}$$

$$b = 6$$

PTS: 2

REF: 011913aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

632 ANS: 2

$$1 = \frac{2\pi}{k}$$

$$k = 2\pi$$

PTS: 2

REF: 012313aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

633 ANS: 1

$$\text{amplitude} = \frac{8-2}{2} = 3, b = \frac{2\pi}{6} = \frac{\pi}{3}, c = \frac{8+2}{2} = 5$$

PTS: 2

REF: 062403aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

634 ANS: 4

$$a = \frac{14-4}{2} = 5, d = \frac{14+4}{2} = 9$$

PTS: 2

REF: 061810aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

635 ANS: 2

PTS: 2

REF: 011701aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

636 ANS: 4

PTS: 2

REF: 061706aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

637 ANS: 3

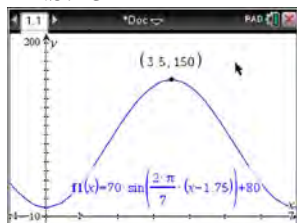
$$T(19) = 8 \sin(0.3(19) - 3) + 74 \approx 77$$

PTS: 2 REF: 061922aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

638 ANS: 2 PTS: 2 REF: 011804aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

639 ANS: 3


 $H(t)$ is at a minimum at $70(-1) + 80 = 10$

PTS: 2 REF: 061613aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

640 ANS: 2

$$-23(1) + 56 = 33; -23(-1) + 56 = 79$$

PTS: 2 REF: 062305aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

641 ANS: 4 PTS: 2 REF: 012016aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

642 ANS: 2 PTS: 2 REF: 081610aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

643 ANS: 4 PTS: 2 REF: 082220aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

644 ANS: 3 PTS: 2 REF: 081705aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

645 ANS: 4

$$1) d(2) = 2; 2) d(1) = 12; 3) d(9) \approx 11; 4) d(-1) = 2$$

PTS: 2 REF: 062220aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

646 ANS: 4

	Bar Harbor	Phoenix
Minimum	31.386	66.491
Midline	55.3	86.729
Maximum	79.214	106.967
Range	47.828	40.476

PTS: 2 REF: 061715aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

647 ANS:

$$2(-1) + 5 = 3$$

PTS: 2 REF: 082429aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

- 648 ANS:
 $250(1) + 2450 = 2700$ The maximum lung capacity of a person is 2700 mL.
- PTS: 2 REF: 081928aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions
- 649 ANS:
 $\frac{h(2) - h(1)}{2 - 1} = -12$, $h(t) = 0$ at $t \approx 2.2, 3.8$, using a graphing calculator to find where $h(t) = 0$.
- PTS: 4 REF: 061836aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions
- 650 ANS: 2 PTS: 2 REF: 082203aai NAT: F.IF.C.7
 TOP: Graphing Trigonometric Functions KEY: amplitude
- 651 ANS: 4 PTS: 2 REF: 081718aai NAT: F.IF.C.7
 TOP: Graphing Trigonometric Functions KEY: amplitude
- 652 ANS:
 $\frac{10.1 - -2}{2} - \frac{2.5 - -0.1}{2} = 6.05 - 1.3 = 4.75$
- PTS: 2 REF: 081930aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: amplitude
- 653 ANS:
 $\frac{25 - 5}{2} = 10$
- PTS: 2 REF: 062525aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: amplitude
- 654 ANS: 1
 $\frac{2\pi}{b} = 12$
 $12b = 2\pi$
 $b = \frac{\pi}{6}$
- PTS: 2 REF: 012520aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: period
- 655 ANS: 2
 $P = \frac{2\pi}{\frac{\pi}{45}} = 90$
- PTS: 2 REF: 081822aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: period

656 ANS: 1

$$P = \frac{2\pi}{\frac{2\pi}{3}} = 3$$

PTS: 2 REF: 082413aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period

657 ANS:

$$\frac{2\pi}{\frac{2\pi}{5}} = 5 \text{ The wheel rotates every 5 minutes.}$$

PTS: 2 REF: 062429aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period

658 ANS:

period is $\frac{2}{3}$. The wheel rotates once every $\frac{2}{3}$ second.

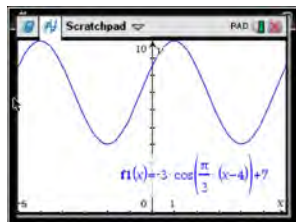
PTS: 2 REF: 061728aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period

659 ANS:

Light wave C. The periods for A, B, and C are 280, 220 and 320.

PTS: 2 REF: 012030aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period

660 ANS: 4



As the range is $[4, 10]$, the midline is $y = \frac{4 + 10}{2} = 7$.

PTS: 2 REF: fall1506aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: mixed

661 ANS: 1

The time of the next high tide will be the midpoint of consecutive low tides.

PTS: 2 REF: 011907aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: mixed

662 ANS: 4

PTS: 2 REF: 081912aai NAT: F.IF.C.7
TOP: Graphing Trigonometric Functions KEY: mixed

663 ANS:

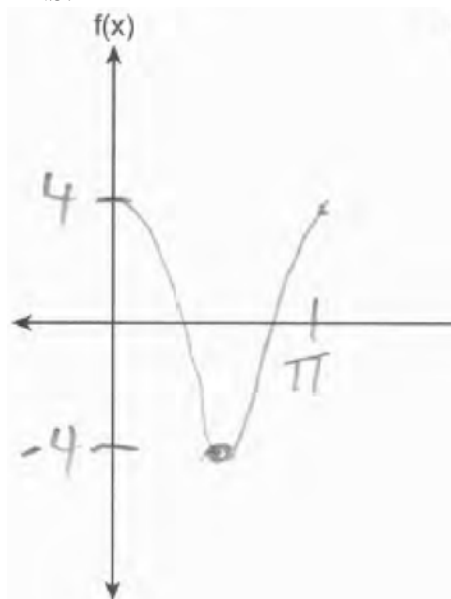
Amplitude, because the height of the graph shows the volume of the air.

PTS: 2 REF: 081625aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: mixed

664 ANS: 3
 (3) repeats 3 times over 2π .

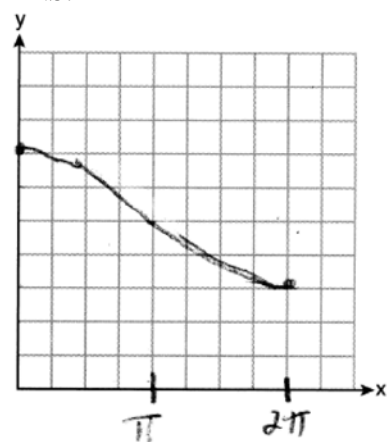
PTS: 2 REF: 011722aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: recognize | bimodalgraph

665 ANS:



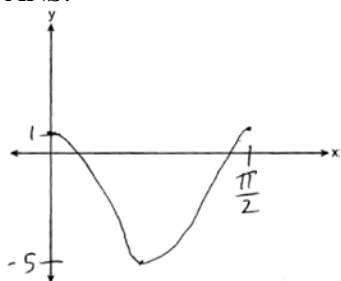
PTS: 2 REF: 062531aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: graph

666 ANS:



PTS: 2 REF: 062231aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
 KEY: graph

667 ANS:



PTS: 2

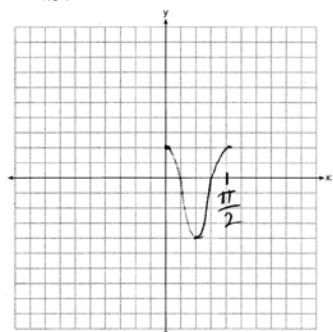
REF: 082328aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

668 ANS:



PTS: 2

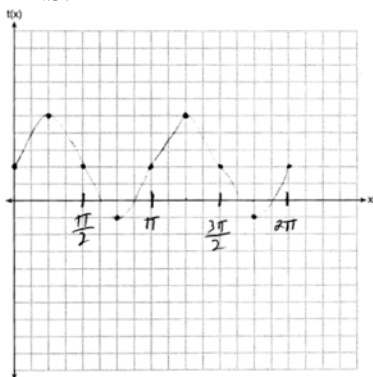
REF: 061628aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

669 ANS:



PTS: 2

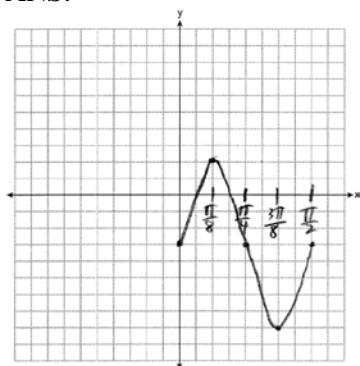
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NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

670 ANS:



PTS: 2

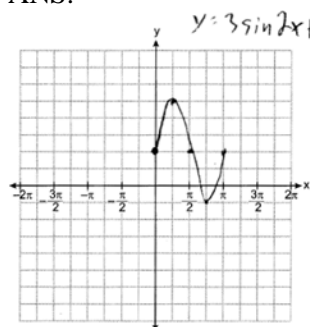
REF: 012529aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

671 ANS:



$$0 < x < \frac{\pi}{4}$$

PTS: 4

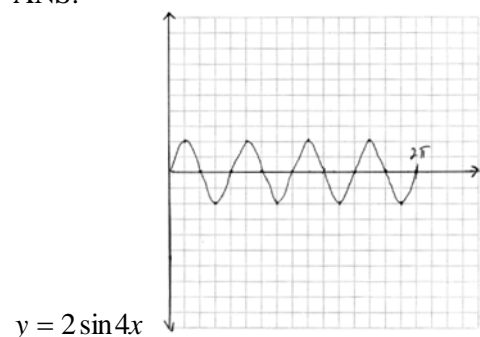
REF: 012436aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

672 ANS:



PTS: 4

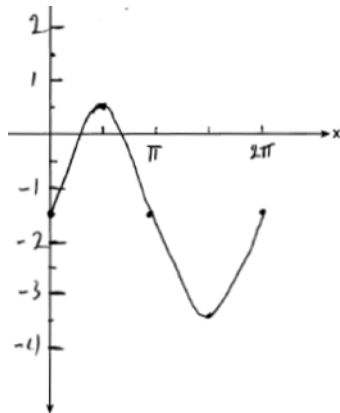
REF: 081934aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

673 ANS:



Part a sketch is shifted $\frac{\pi}{3}$ units right.

PTS: 4

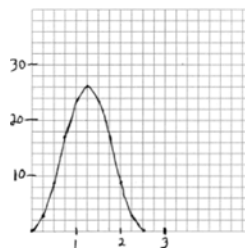
REF: 081735aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

674 ANS:



period = $\frac{2\pi}{0.8\pi} = 2.5$. The wheel rotates once every 2.5 seconds.
of $f(t) = 26$.

No, because the maximum

PTS: 6

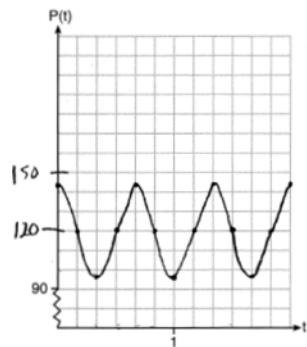
REF: 061937aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

675 ANS:



The period of P is $\frac{2}{3}$, which means the patient's blood pressure reaches a high every $\frac{2}{3}$ second and a low every $\frac{2}{3}$ second. The patient's blood pressure is high because 144 over 96 is greater than 120 over 80.

PTS: 6

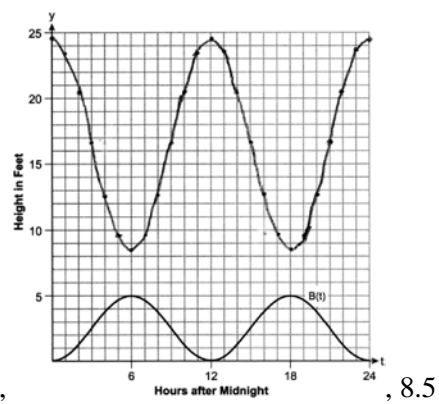
REF: 011837aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

676 ANS:



$$12, B(t) = -2.5 \cos \frac{\pi}{6} t + 2.5, \quad 8.5$$

PTS: 6

REF: 082537a

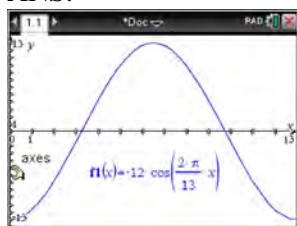
NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

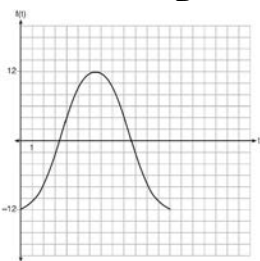
KEY: graph

Algebra II Regents Exam Questions by State Standard: Topic Answer Section

677 ANS:



The amplitude, 12, can be interpreted from the situation, since the water level has a minimum of -12 and a maximum of 12 . The value of A is -12 since at 8:30 it is low tide. The period of the function is 13 hours, and is expressed in the function through the parameter B . By experimentation with technology or using the relation $P = \frac{2\pi}{B}$ (where P is the period), it is determined that $B = \frac{2\pi}{13}$.



$$f(t) = -12 \cos\left(\frac{2\pi}{13} t\right)$$

In order to answer the question about when to fish, the student must interpret the function and determine which choice, 7:30 pm or 10:30 pm, is on an increasing interval. Since the function is increasing from $t = 13$ to $t = 19.5$ (which corresponds to 9:30 pm to 4:00 am), 10:30 is the appropriate choice.

PTS: 6 REF: spr1514aia NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: graph

678 ANS: 4

$$4(x^2 - 6x + 9) + 4(y^2 + 18y + 81) = 76 + 36 + 324$$

$$4(x - 3)^2 + 4(y + 9)^2 = 436$$

PTS: 2 REF: 061619aia NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: completing the square

679 ANS: 3

$$.71 + .52 - .77 = .46$$

PTS: 2 REF: 062509aia NAT: S.CP.B.7 TOP: Addition Rule

680 ANS: 4

$$45\% + 31\% - 58\% = 18\%$$

PTS: 2 REF: 082307aia NAT: S.CP.B.7 TOP: Addition Rule

681 ANS: 3

$$\frac{1}{3} + \frac{1}{7} - \frac{9}{21} = \frac{7}{21} + \frac{3}{21} - \frac{9}{21} = \frac{1}{21}$$

PTS: 2 REF: 082410aia NAT: S.CP.B.7 TOP: Addition Rule

682 ANS: 2
 $40 - (20 + 22 - 15) = 13$

PTS: 2 REF: 062204aai NAT: S.CP.B.7 TOP: Addition Rule

683 ANS:

$$P(S \cap M) = P(S) + P(M) - P(S \cup M) = \frac{649}{1376} + \frac{433}{1376} - \frac{974}{1376} = \frac{108}{1376}$$

PTS: 2 REF: 061629aai NAT: S.CP.B.7 TOP: Addition Rule

684 ANS:

$$\frac{165 + 66 - 33}{825} = \frac{198}{825}$$

PTS: 2 REF: 081925aai NAT: S.CP.B.7 TOP: Addition Rule

685 ANS:

$$.74 \cdot .24 = .1776 \quad .74 + .24 - .1776 = .8024$$

PTS: 4 REF: 012533aai NAT: S.CP.B.7 TOP: Addition Rule

686 ANS:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ A and B are independent since $P(A \cap B) = P(A) \cdot P(B)$

$$0.8 = 0.6 + 0.5 - P(A \cap B) \qquad 0.3 = 0.6 \cdot 0.5$$

$$P(A \cap B) = 0.3 \qquad 0.3 = 0.3$$

PTS: 2 REF: 081632aai NAT: S.CP.B.7 TOP: Addition Rule

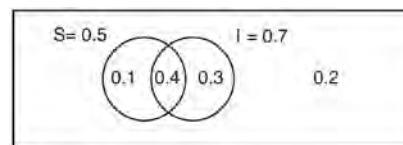
687 ANS:

$$\frac{47}{108} = \frac{1}{4} + \frac{116}{459} - P(M \text{ and } J); \text{ No, because } \frac{31}{459} \neq \frac{1}{4} \cdot \frac{116}{459}$$

$$P(M \text{ and } J) = \frac{31}{459}$$

PTS: 4 REF: 011834aai NAT: S.CP.B.7 TOP: Addition Rule

688 ANS:



This scenario can be modeled with a Venn Diagram:

Since

$P(S \cup I) = 0.2$, $P(S \cup I) = 0.8$. Then, $P(S \cap I) = P(S) + P(I) - P(S \cup I)$ If S and I are independent, then the

$$= 0.5 + 0.7 - 0.8$$

$$= 0.4$$

Product Rule must be satisfied. However, $(0.5)(0.7) \neq 0.4$. Therefore, salary and insurance have not been treated independently.

PTS: 4 REF: spr1513aai NAT: S.CP.B.7 TOP: Addition Rule

689 ANS: 2

$$\frac{17+60-7}{100} = \frac{70}{100}$$

PTS: 2 REF: 082517aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

690 ANS: 4

$$\frac{13}{13+11} = \frac{13}{24}$$

PTS: 2 REF: 012011aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

691 ANS: 1

$$\frac{20}{14+20+6} = \frac{1}{2}$$

PTS: 2 REF: 082303aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

692 ANS: 1

$$\frac{157}{25+47+157}$$

PTS: 2 REF: 081607aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

693 ANS: 1
 The probability of being late given that a student walked is $\frac{4}{22}$. The probability that student walked given that the student was late is $\frac{4}{30}$.

PTS: 2 REF: 012518aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

694 ANS:

$$\frac{45}{45+15} = \frac{45}{60}$$

PTS: 2 REF: 082525aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

695 ANS:

$$\frac{103}{110+103} = \frac{103}{213}$$

PTS: 2 REF: 061825aii NAT: S.CP.A.4 TOP: Conditional Probability
 KEY: table

696 ANS:

A student is more likely to jog if both siblings jog. 1 jogs: $\frac{416}{2239} \approx 0.19$. both jog: $\frac{400}{1780} \approx 0.22$

PTS: 2 REF: 061732aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

697 ANS: 1

$$\frac{8+12}{120} \cdot \frac{8+40}{120} = \frac{8}{120}$$

$$\frac{1}{6} \cdot \frac{4}{10} = \frac{1}{15}$$

$$\frac{4}{60} = \frac{1}{15}$$

PTS: 2 REF: 082422aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

698 ANS:

$$\frac{94}{87+94+21} = \frac{94}{202}$$

PTS: 2 REF: 062528aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

699 ANS:

No, because $P(M/R) \neq P(M)$

$$\frac{70}{180} \neq \frac{230}{490}$$

$$0.38 \neq 0.47$$

PTS: 2 REF: 011731aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

700 ANS:

$P(F|L) = \frac{12}{27}$ $P(F) = \frac{22}{45}$ Since $P(F|L) \neq P(F)$, the events are not independent.

PTS: 4 REF: 061936aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

701 ANS:

Yes. $P(BI) = P(BI|GI)$

$$0.14 + 0.26 = \frac{.14}{.35}$$

$$.4 = .4$$

PTS: 2 REF: 062229aai NAT: S.CP.A.4 TOP: Conditional Probability
KEY: table

702 ANS:

Based on these data, the two events do not appear to be independent. $P(J) = \frac{145}{277} = 0.52$, while

$P(J|D) = \frac{58}{139} = 0.42$. The probability of being a junior is not the same as the conditional probability of being a junior, given the junior drives to school.

PTS: 2 REF: 062431aii NAT: S.CP.A.4 TOP: Conditional Probability

KEY: table

703 ANS:

No, because $P(F/CR) \neq P(F)$

$$\frac{36}{42+36} \neq \frac{17+37+36+15}{39+17+42+12+17+37+36+15}$$

$$\frac{36}{78} \neq \frac{105}{215}$$

$$\frac{6}{13} \neq \frac{21}{43}$$

PTS: 2 REF: 082231aii NAT: S.CP.A.4 TOP: Conditional Probability

KEY: table

704 ANS:

Based on these data, the two events do not appear to be independent. $P(F) = \frac{106}{200} = 0.53$, while

$P(F|T) = \frac{54}{90} = 0.6$, $P(F|R) = \frac{25}{65} = 0.39$, and $P(F|C) = \frac{27}{45} = 0.6$. The probability of being female are not the same as the conditional probabilities. This suggests that the events are not independent.

PTS: 2 REF: fall1508aii NAT: S.CP.A.4 TOP: Conditional Probability

KEY: table

705 ANS:

$\frac{1200}{1200+2016} \approx .373$. Yes, because $\frac{1600}{4288} \approx .373$ also.

PTS: 4 REF: 062334aii NAT: S.CP.A.4 TOP: Conditional Probability

KEY: table

706 ANS:

$\frac{3+42}{1500} = 3\%$ $\frac{3}{3+12} = 20\%$ No, because a person is more likely to be allergic milk if he is also allergic to nuts.

PTS: 4 REF: 012433aii NAT: S.CP.A.4 TOP: Conditional Probability

KEY: table

707 ANS: 3

PTS: 2

REF: 061607aii

NAT: S.IC.A.2

TOP: Analysis of Data

708 ANS: 2

PTS: 2

REF: 011820aii

NAT: S.IC.A.2

TOP: Analysis of Data

- 709 ANS: 3 PTS: 2 REF: 061710aai NAT: S.IC.A.2
TOP: Analysis of Data
- 710 ANS: 4 PTS: 2 REF: 012014aai NAT: S.IC.A.2
TOP: Analysis of Data
- 711 ANS:
Since there are six flavors, each flavor can be assigned a number, 1-6. Use the simulation to see the number of times the same number is rolled 4 times in a row.
- PTS: 2 REF: 081728aai NAT: S.IC.A.2 TOP: Analysis of Data
- 712 ANS:
.705 ± 2(.045) No, because .67 falls within the confidence interval.
.615 – .795
- PTS: 2 REF: 062532aai NAT: S.IC.A.2 TOP: Analysis of Data
- 713 ANS:
No. 0.852 ± 2(0.029) → 0.794 – 0.91. 0.88 falls within this interval.
- PTS: 2 REF: 062332aai NAT: S.IC.A.2 TOP: Analysis of Data
- 714 ANS:
No. 0.499 ± 2(0.049) → 0.401 – 0.597. Since 0.43 falls within this interval, Robin’s coin is likely not unfair.
- PTS: 2 REF: 061932aai NAT: S.IC.A.2 TOP: Analysis of Data
- 715 ANS:
Yes. Using a 95% confidence interval, values outside the interval 3.95 – 4.05 are unusual.
- PTS: 2 REF: 012532aai NAT: S.IC.A.2 TOP: Analysis of Data
- 716 ANS:
2(0.042) = 0.084 ≈ 0.08 The percent of users making in-app purchases will be within 8% of 35%.
- PTS: 2 REF: 081832aai NAT: S.IC.A.2 TOP: Analysis of Data
- 717 ANS:
 $\frac{1}{10}, \frac{1}{5}$, and no, since 0.10 clearly falls within 95% of 0.20.
- PTS: 4 REF: 012334aai NAT: S.IC.A.2 TOP: Analysis of Data
- 718 ANS:
42.029 ± 2 · 3.105 ≈ 35.82 – 48.24. Yes, since 49.8 falls outside the 95% interval.
- PTS: 4 REF: 082434aai NAT: S.IC.A.2 TOP: Analysis of Data
- 719 ANS:
0.301 ± 2(0.058) → 0.185 – 0.417 $\frac{14}{60} \approx 0.23$. It is not unusual because 0.23 falls within this interval.
- PTS: 4 REF: 081935aai NAT: S.IC.A.2 TOP: Analysis of Data

720 ANS:
 $0.602 \pm 2 \cdot 0.066 = 0.47 - 0.73$. Since 0.50 falls within the 95% interval, this supports the concern there may be an even split.

PTS: 4 REF: 061635aai NAT: S.IC.A.2 TOP: Analysis of Data

721 ANS:
 $.651 \pm 2 \cdot .034 = .58 - .72$. No, since .61 (122/200) falls within the 95% interval.

PTS: 4 REF: 062235aai NAT: S.IC.A.2 TOP: Analysis of Data

722 ANS:
 $138.905 \pm 2 \cdot 7.95 = 123 - 155$. No, since 125 (50% of 250) falls within the 95% interval.

PTS: 4 REF: 011835aai NAT: S.IC.A.2 TOP: Analysis of Data

723 ANS:
 $.795 \pm 2 \cdot .085 = .625 - .965$. Yes, as it is plausible at least .625 of the customers will purchase both.

PTS: 4 REF: 062435aai NAT: S.IC.A.2 TOP: Analysis of Data

724 ANS:
 $29.101 \pm 2 \cdot 0.934 = 27.23 - 30.97$. Yes, since 30 falls within the 95% interval.

PTS: 4 REF: 011935aai NAT: S.IC.A.2 TOP: Analysis of Data

725 ANS:
 $.819 \pm 2 \cdot .053 = .713 - .925$. Since .70 does not fall within the 95% interval.

PTS: 4 REF: 082236aai NAT: S.IC.A.2 TOP: Analysis of Data

726 ANS:
 $0.506 \pm 2 \cdot 0.078 = 0.35 - 0.66$. The 32.5% value falls below the 95% confidence level.

PTS: 4 REF: 061736aai NAT: S.IC.A.2 TOP: Analysis of Data

727 ANS:
 Yes. The margin of error from this simulation indicates that 95% of the observations fall within ± 0.12 of the simulated proportion, 0.25. The margin of error can be estimated by multiplying the standard deviation, shown to be 0.06 in the dotplot, by 2, or applying the estimated standard error formula, $\left(\sqrt{\frac{p(1-p)}{n}} \right)$ or $\left(\sqrt{\frac{(0.25)(0.75)}{50}} \right)$

and multiplying by 2. The interval 0.25 ± 0.12 includes plausible values for the true proportion of people who prefer Stephen's new product. The company has evidence that the population proportion could be at least 25%. As seen in the dotplot, it can be expected to obtain a sample proportion of 0.18 (9 out of 50) or less several times, even when the population proportion is 0.25, due to sampling variability. Given this information, the results of the survey do not provide enough evidence to suggest that the true proportion is not at least 0.25, so the development of the product should continue at this time.

PTS: 4 REF: spr1512aai NAT: S.IC.A.2 TOP: Analysis of Data

728 ANS: 3 PTS: 2 REF: 012015aai NAT: S.IC.B.3
 TOP: Analysis of Data

729 ANS: 3 PTS: 2 REF: 062502aai NAT: S.IC.B.3
 TOP: Analysis of Data

- 730 ANS: 1 PTS: 2 REF: 012502aii NAT: S.IC.B.3
TOP: Analysis of Data
- 731 ANS: 2 PTS: 2 REF: 082505aii NAT: S.IC.B.3
TOP: Analysis of Data
- 732 ANS: 2 PTS: 2 REF: 081802aii NAT: S.IC.B.3
TOP: Analysis of Data
- 733 ANS: 3 PTS: 2 REF: 061901aii NAT: S.IC.B.3
TOP: Analysis of Data
- 734 ANS: 4 PTS: 2 REF: 081906aii NAT: S.IC.B.3
TOP: Analysis of Data
- 735 ANS: 4 PTS: 2 REF: 062216aii NAT: S.IC.B.3
TOP: Analysis of Data
- 736 ANS: 3 PTS: 2 REF: 082401aii NAT: S.IC.B.3
TOP: Analysis of Data
- 737 ANS: 2 PTS: 2 REF: 082204aii NAT: S.IC.B.3
TOP: Analysis of Data
- 738 ANS: 3 PTS: 2 REF: 012401aii NAT: S.IC.B.3
TOP: Analysis of Data
- 739 ANS: 2 PTS: 2 REF: 081717aii NAT: S.IC.B.3
TOP: Analysis of Data
- 740 ANS: 4 PTS: 2 REF: 012314aii NAT: S.IC.B.3
TOP: Analysis of Data
- 741 ANS: 3 PTS: 2 REF: 011706aii NAT: S.IC.B.3
TOP: Analysis of Data
- 742 ANS: 3

between 000 and 449, inclusive $\rightarrow \frac{450}{1000} = 45\%$

- PTS: 2 REF: 012024aii NAT: S.IC.B.3 TOP: Analysis of Data
- 743 ANS: 1 PTS: 2 REF: 012506aii NAT: S.IC.B.3
TOP: Analysis of Data
- 744 ANS:
Randomly assign participants to two groups. One group uses the toothpaste with ingredient X and the other group uses the toothpaste without ingredient X .
- PTS: 2 REF: 061626aii NAT: S.IC.B.3 TOP: Analysis of Data
- 745 ANS: 2 PTS: 2 REF: 062505aii NAT: S.IC.B.4
TOP: Analysis of Data
- 746 ANS: 4
 $2 \times 0.035 = 0.07$
- PTS: 2 REF: 012319aii NAT: S.IC.B.4 TOP: Analysis of Data

747 ANS: 2

$$ME = \left(z \sqrt{\frac{p(1-p)}{n}} \right) = \left(1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \right) \approx 0.03 \text{ or } \frac{1}{\sqrt{900}} \approx 0.03$$

PTS: 2 REF: 081612aai NAT: S.IC.B.4 TOP: Analysis of Data

748 ANS: 2

$$\frac{212}{1334} \approx .16 \quad ME = \left(z \sqrt{\frac{p(1-p)}{n}} \right) = \left(1.96 \sqrt{\frac{(0.16)(0.84)}{1334}} \right) \approx 0.02 \text{ or } \frac{1}{\sqrt{1334}} \approx .027$$

PTS: 2 REF: 081716aai NAT: S.IC.B.4 TOP: Analysis of Data

749 ANS: 2

.43 \pm 2(0.05) contains about 95% of the data.

PTS: 2 REF: 062317aai NAT: S.IC.B.4 TOP: Analysis of Data

750 ANS: 2

0.254 \pm 2(0.060) \rightarrow (0.134, 0.374)

PTS: 2 REF: 061913aai NAT: S.IC.B.4 TOP: Analysis of Data

751 ANS: 2

9.82 \pm 2(1.4)

PTS: 2 REF: 012411aai NAT: S.IC.B.6 TOP: Analysis of Data

KEY: draw conclusions

752 ANS: 1

PTS: 2

REF: 081722aai

NAT: S.IC.B.6

TOP: Analysis of Data

KEY: draw conclusions

753 ANS: 3

PTS: 2

REF: 082201aai

NAT: S.IC.B.6

TOP: Analysis of Data

KEY: draw conclusions

754 ANS: 3

PTS: 2

REF: 012418aai

NAT: S.IC.B.6

TOP: Analysis of Data

KEY: draw conclusions

755 ANS:

About 38% $\left(\frac{475}{1250} \right)$ of high school juniors in the population will choose a four-year college.

PTS: 2 REF: 012432aai NAT: S.IC.B.6 TOP: Analysis of Data

KEY: draw conclusions

756 ANS:

sample: pails of oranges; population: truckload of oranges. It is likely that about 5% of all the oranges are unsatisfactory.

PTS: 2 REF: 011726aai NAT: S.IC.B.6 TOP: Analysis of Data

KEY: draw conclusions

- 757 ANS:
Using a 95% level of confidence, $x \pm 2$ standard deviations sets the usual wait time as 150-302 seconds. 360 seconds is unusual.
- PTS: 2 REF: 081629aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: draw conclusions
- 758 ANS: 3
Self selection causes bias.
- PTS: 2 REF: 061703aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 759 ANS: 4 PTS: 2 REF: 011801aai NAT: S.IC.B.6
TOP: Analysis of Data KEY: bias
- 760 ANS: 2 PTS: 2 REF: 011910aai NAT: S.IC.B.6
TOP: Analysis of Data KEY: bias
- 761 ANS: 3
To determine student opinion, survey the widest range of students.
- PTS: 2 REF: 062202aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 762 ANS: 4 PTS: 2 REF: 082301aai NAT: S.IC.B.6
TOP: Analysis of Data KEY: bias
- 763 ANS: 1
II. Ninth graders drive to school less often; III. Students know little about adults; IV. Calculus students love math!
- PTS: 2 REF: 081602aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 764 ANS:
Self selection is a cause of bias because people with more free time are more likely to respond.
- PTS: 2 REF: 061828aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 765 ANS:
The opinion sought is that of the entire student body, but the first period computer science class may not be representative of the entire student body.
- PTS: 2 REF: 062427aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 766 ANS:
Pick random names from a list of all students and ask each one his method.
- PTS: 2 REF: 062325aai NAT: S.IC.B.6 TOP: Analysis of Data
KEY: bias
- 767 ANS: 3
 $y = 40(1.2)^8 \approx 168$
- PTS: 2 REF: 062406aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

768 ANS: 3

$$y = 1.77(1.18)^x \quad y(41) \approx 1,850,950$$

PTS: 2 REF: 062314aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

769 ANS:

$$y = 2.459(1.616)^x$$

PTS: 2 REF: 012329aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

770 ANS:

$$D = 1.223(2.652)^A$$

PTS: 2 REF: 011826aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

771 ANS:

$$F(t) = 169.136(.971)^t$$

PTS: 2 REF: 062232aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

772 ANS:

$$y = 4.168(3.981)^x \quad 100 = 4.168(3.981)^x$$

$$\log \frac{100}{4.168} = \log(3.981)^x$$

$$\log \frac{100}{4.168} = x \log(3.981)$$

$$\frac{\log \frac{100}{4.168}}{\log(3.981)} = x$$

$$x \approx 2.25$$

PTS: 4 REF: 081736aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

773 ANS:

$$y = 101.523(.883)^x \quad 29 = 101.523(.883)^x$$

$$\frac{29}{101.523} = (.883)^x$$

$$\log \frac{29}{101.523} = x \log(.883)$$

$$\frac{\log \frac{29}{101.523}}{\log(.883)} = x$$

$$x \approx 10.07$$

PTS: 4 REF: 012036aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

774 ANS:

$$y = 9290.57(1.02)^x \quad 15000 = 9290.57(1.02)^x$$

$$\log \frac{15000}{9290.57} = \log 1.02^x$$

$$\log \frac{15000}{9290.57} = x \log 1.02$$

$$\frac{\log \frac{15000}{9290.57}}{\log 1.02} = x$$

$$24.2 = x$$

PTS: 4 REF: 082533aai NAT: S.ID.B.6 TOP: Regression
KEY: exponential

775 ANS: 1 PTS: 2 REF: 082406aai NAT: S.ID.B.6
TOP: Regression KEY: choose model

776 ANS: 2 PTS: 2 REF: 061804aai NAT: S.ID.B.6
TOP: Regression KEY: choose model

777 ANS: 3

The pattern suggests an exponential pattern, not linear or sinusoidal. A 4% growth rate is accurate, while a 43% growth rate is not.

PTS: 2 REF: 011713aai NAT: S.ID.B.6 TOP: Regression
KEY: choose model

778 ANS: 2 PTS: 2 REF: 011901aai NAT: S.ID.A.4
TOP: Normal Distributions KEY: mean and standard deviation

779 ANS:

$$\frac{16-8}{4} = 2$$

PTS: 2 REF: 082528aai NAT: S.ID.A.4 TOP: Normal Distributions

780 ANS: 2



$\bar{x} + 2\sigma$ represents approximately 48% of the data.

PTS: 2 REF: 061609aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

781 ANS: 3



$\bar{x} + 2\sigma$ represents approximately 99.1% of the data.

PTS: 2 REF: 012514aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

782 ANS:



43

PTS: 2 REF: 012328aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

783 ANS:



25

PTS: 2 REF: 012429aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

784 ANS: 2 PTS: 2 REF: 082313aai NAT: S.ID.A.4
TOP: Normal Distributions KEY: percent

785 ANS: 1



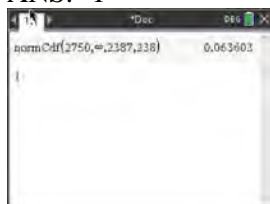
PTS: 2 REF: 081711aai NAT: S.ID.A.4 TOP: Normal Distributions
 KEY: percent

786 ANS: 1



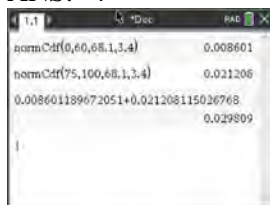
PTS: 2 REF: 081919aai NAT: S.ID.A.4 TOP: Normal Distributions
 KEY: percent

787 ANS: 1



PTS: 2 REF: 082507aai NAT: S.ID.A.4 TOP: Normal Distributions
 KEY: percent

788 ANS: 4



PTS: 2 REF: 062316aai NAT: S.ID.A.4 TOP: Normal Distributions
 KEY: percent

789 ANS:



69

PTS: 2

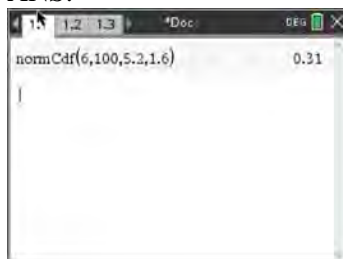
REF: 061726aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: percent

790 ANS:



PTS: 2

REF: 082428aai

NAT: S.ID.A.4

TOP: Normal Distributions

791 ANS: 3



PTS: 2

REF: 081604aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: probability

792 ANS: 2



PTS: 2

REF: 061817aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: probability

793 ANS:

$$\text{normcdf}(510, 540, 480, 24) = 0.0994 \quad z = \frac{510 - 480}{24} = 1.25 \quad 1.25 = \frac{x - 510}{20} \quad 2.5 = \frac{x - 510}{20} \quad 535-560$$

$$z = \frac{540 - 480}{24} = 2.5 \quad x = 535 \quad x = 560$$

PTS: 4 REF: fall1516aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: probability

794 ANS: 4

$$496 \pm 2(115)$$

PTS: 2 REF: 011718aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: interval

795 ANS: 3

$$2.12 \pm 2(.05)$$

PTS: 2 REF: 012509aai NAT: S.ID.A.4 TOP: Normal Distributions

796 ANS: 1

TOP: Normal Distributions

PTS: 2

REF: 062214aai

NAT: S.ID.A.4

KEY: predict

797 ANS: 3

$$440 \times 2.3\% \approx 10$$

PTS: 2 REF: 011807aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

798 ANS: 4

$$49 \times 16.7\% \approx 8$$

PTS: 2 REF: 062418aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

799 ANS: 1

$$84.1\% \times 750 \approx 631$$

PTS: 2 REF: 011923aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

800 ANS: 4

$$400 \cdot .954 \approx 380$$

PTS: 2 REF: 061918aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

801 ANS:

$$1200 \cdot 0.784 \approx 941$$

PTS: 2 REF: 081828aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

802 ANS:
 $0.133696 \times 9256 \approx 1237$

PTS: 2 REF: 082230aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

803 ANS:
 $750 \mp 2(20) \ 50\% + 19.1\% \approx 69\%$
 $710 - 790$

PTS: 4 REF: 062534aai NAT: S.ID.A.4 TOP: Normal Distributions