



- 10 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)  $\frac{40 + 100x}{x + 1} = 80$

3)  $\frac{40 + 100 + x}{x} = 80$

2)  $\frac{40 + 100x}{x} = 80$

4)  $\frac{40 + 100 + x}{x + 1} = 80$

- 11 Given  $f(x) = \ln(x + 5)$ , what is the *smallest* integer value of  $x$  for which  $f(x)$  is defined?

1)  $-5$

3)  $-1$

2)  $-4$

4)  $0$

- 12 Which expression is equivalent to  $\frac{6x^3 + 7x^2 - 9x - 1}{2x - 1}$  when  $x \neq \frac{1}{2}$ ?

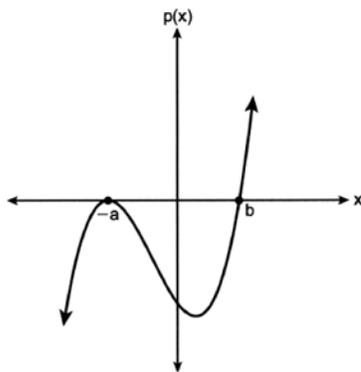
1)  $3x^2 - 2x - 4$

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

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

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

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



An equation for  $p(x)$  could be

1)  $p(x) = (x + a)(x - b)$

3)  $p(x) = (x - a)(x + b)$

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

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

- 14 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  $f(x) = g(x)$ ?

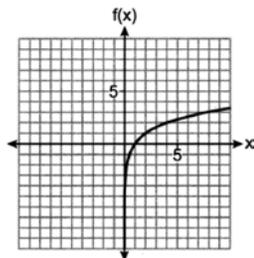
1)  $-6.9$

3)  $2.2$

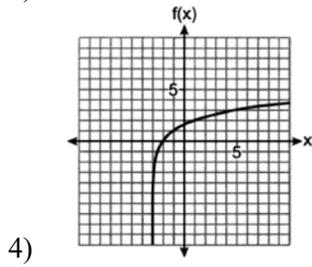
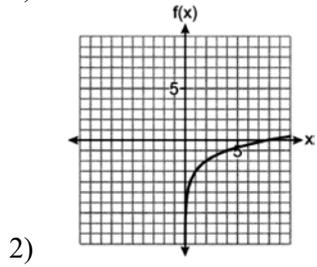
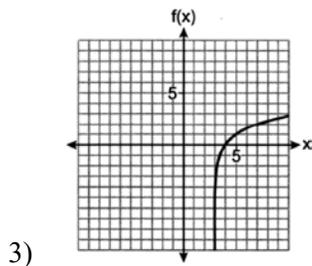
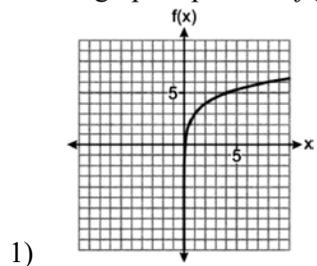
2)  $-1.4$

4)  $9.8$

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



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



16 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)  $(4, 2)$

17 At a high school, 10<sup>th</sup>-grade students were recently asked if they walk to school and if they eat breakfast. The survey results are summarized in the table below.

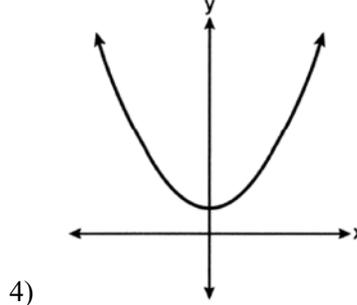
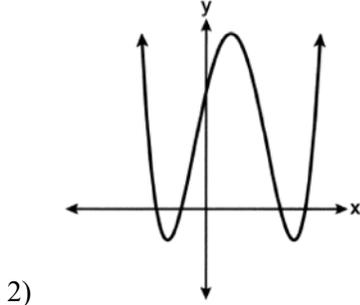
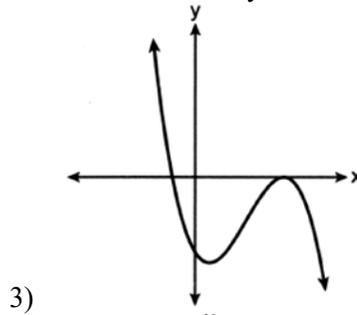
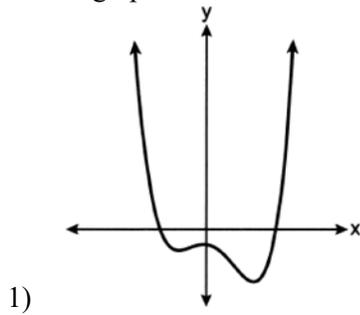
	<b>Walks to School</b>	<b>Doesn't Walk to School</b>
<b>Eats Breakfast</b>	7	53
<b>Doesn't Eat Breakfast</b>	10	30

What is the probability that a randomly selected 10<sup>th</sup>-grade student from the school walks to school or eats breakfast?

- 1) 0.07
- 2) 0.70
- 3) 0.77
- 4) 0.84



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

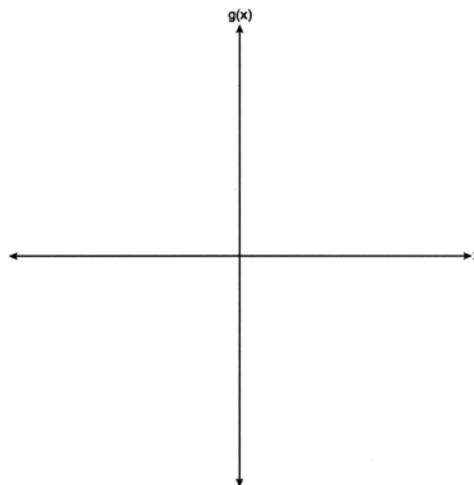


25 Seniors at a high school were surveyed to see if they preferred a hoodie or a jacket for Spirit Day and if they wanted a design on the back or the front. The survey results are summarized in the table below.

	Hoodie	Jacket
Back	45	15
Front	27	13

Determine the exact probability that a randomly selected senior from the survey preferred a hoodie, given that the senior wanted a design on the back.

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



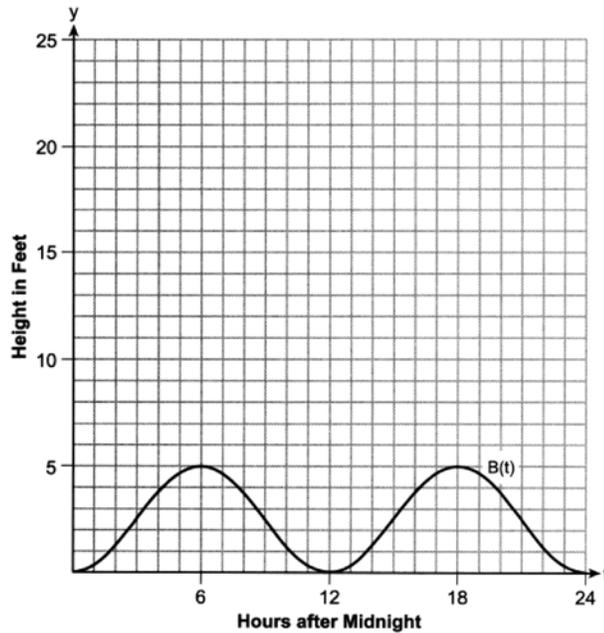
27 Express  $8xi^{10} - 4yi^{19} + 2yi^3 - 6xi$  in simplest form, where  $i$  is the imaginary unit.

- 28 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.
- 29 An angle,  $\theta$ , is drawn in standard position and terminates in Quadrant III. Given  $\cos \theta = -\frac{\sqrt{10}}{10}$ , determine the value of  $\tan \theta$ .
- 30 Solve algebraically for all values of  $x$ :  $\sqrt{x+5} - x = 3$
- 31 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*.
- 32 Algebraically determine the solution(s) to the equation  $2x^2 = 2x - 1$ , in simplest  $a + bi$  form.
- 33 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.
- 34 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  $f(x)$ .
- 35 Solve the system algebraically:  $2a + b - c = -4$
- $$4a + b + c = 3$$
- $$-2a - 3b + 2c = 11$$
- 36 Given:  $f(x) = 5x^2 + 3x - 12$  and  $g(x) = 2x - 1$ . Express  $4g(x) - [f(x + 1)]$  as a polynomial in standard form.

- 37 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.

## 0825aii

## Answer Section

1 ANS: 1

$$a_7 = -2(-3)^{7-1} = -1458$$

PTS: 2

REF: 082501aii

NAT: F.BF.A.2

TOP: Sequences

KEY: explicit

2 ANS: 2

$$\frac{12x^{8a}}{3x^{2a}}$$

PTS: 2

REF: 082502aii

NAT: F.BF.A.1

TOP: Operations with Functions

3 ANS: 3

$$x = 2y + 6$$

$$x - 6 = 2y$$

$$\frac{x}{2} - 3 = y$$

PTS: 2

REF: 082503aii

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

4 ANS: 3

$$\sqrt[3]{16x^6} = \sqrt[3]{8 \cdot 2 \cdot x^6} = \sqrt[3]{8} \sqrt[3]{x^6} \sqrt[3]{2} = 2x^2 \sqrt[3]{2}$$

PTS: 2

REF: 082504aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

5 ANS: 2

PTS: 2

REF: 082505aii

NAT: S.IC.B.3

TOP: Analysis of Data

6 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: 082506aii

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: factoring

7 ANS: 1



PTS: 2

REF: 082507aii

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: percent

8 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

9 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

10 ANS: 1

PTS: 2

REF: 082510aai

NAT: A.CED.A.1

TOP: Modeling Rationals

11 ANS: 2

PTS: 2

REF: 082511aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

12 ANS: 4

$$\begin{array}{r} 3x^2 + 5x - 2 \\ 2x - 1 \overline{) 6x^3 + 7x^2 - 9x - 1} \\ \underline{6x^3 - 3x^2} \phantom{- 1} \\ 10x^2 - 9x \phantom{- 1} \\ \underline{10x^2 - 5x} \phantom{- 1} \\ -4x - 1 \\ \underline{-4x + 2} \\ -3 \end{array}$$

PTS: 2

REF: 082512aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

13 ANS: 2

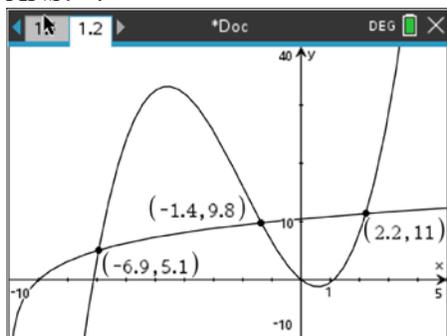
PTS: 2

REF: 082513aai

NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

14 ANS: 4



PTS: 2 REF: 082514aai NAT: A.REI.D.11 TOP: Other Systems  
KEY: logarithmic

15 ANS: 4 PTS: 2 REF: 082515aai NAT: F.BF.B.3  
TOP: Transformations with Functions

16 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

17 ANS: 2

$$\frac{17 + 60 - 7}{100} = \frac{70}{100}$$

PTS: 2 REF: 082517aai NAT: S.CP.A.4 TOP: Conditional Probability

18 ANS: 4 PTS: 2 REF: 082518aai NAT: F.BF.A.2  
TOP: Sequences KEY: recursive, geometric

19 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

20 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

21 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: 082521aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

22 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

23 ANS: 1

$p = \frac{3 - -5}{2} = \frac{8}{2} = 4$  The vertex is  $(2, -1)$ . Since the directrix is about the focus, the parabola opens downward.

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

$$y + 1 = -\frac{1}{16}(x - 2)^2$$

$$-16(y + 1) = (x - 2)^2$$

PTS: 2 REF: 082523aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

24 ANS: 1

PTS: 2

REF: 082524aai

NAT: F.IF.B.4

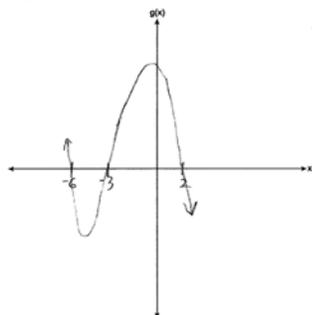
TOP: Graphing Polynomial Functions

25 ANS:

$$\frac{45}{45 + 15} = \frac{45}{60}$$

PTS: 2 REF: 082525aai NAT: S.CP.A.4 TOP: Conditional Probability

26 ANS:



PTS: 2 REF: 082526aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

27 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

28 ANS:

$$\frac{16-8}{4} = 2$$

PTS: 2 REF: 082528aai NAT: S.ID.A.4 TOP: Normal Distributions

29 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

30 ANS:

$$\sqrt{x+5} = x+3 \qquad -4 \text{ is extraneous.}$$

$$x+5 = x^2 + 6x + 9$$

$$0 = x^2 + 5x + 4$$

$$0 = (x+4)(x+1)$$

$$x = -4, -1$$

PTS: 2 REF: 082530aai NAT: A.REI.A.2 TOP: Solving Radicals

31 ANS:

$$S_{30} = \frac{42000 - 42000(1.03)^{30}}{1 - 1.03} \approx 1,998,000$$

PTS: 2 REF: 082531aai NAT: F.BF.B.7 TOP: Series

KEY: geometric

32 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

33 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

34 ANS:

$$\text{Yes, } x^3 + 3x^2 - 2x - 6 \quad (x^2 - 2)(x + 3) = 0$$

$$x^2(x + 3) - 2(x + 3) \quad x = \pm\sqrt{2}, -3$$

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

PTS: 4 REF: 082534aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

35 ANS:

$$4a + 2b - 2c = -8 \quad -4b + 2c = 14 \quad -5b + 5c = 25 \quad 2b + 7 = b + 5 \quad c = -2 + 5 = 3 \quad 2a - 2 - 3 = -4$$

$$4a + b + c = 3 \quad -2b + c = 7 \quad -b + c = 5 \quad b = -2 \quad 2a - 5 = -4$$

$$-4a - 6b + 4c = 22 \quad c = 2b + 7 \quad c = b + 5 \quad 2a = 1$$

$$a = \frac{1}{2}$$

PTS: 4 REF: 082535aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

36 ANS:

$$4(2x - 1) - (5(x + 1)^2 + 3(x + 1) - 12)$$

$$8x - 4 - (5(x^2 + 2x + 1) + 3x + 3 - 12)$$

$$8x - 4 - (5x^2 + 10x + 5 + 3x - 9)$$

$$8x - 4 - (5x^2 + 13x - 4)$$

$$-5x^2 - 5x$$

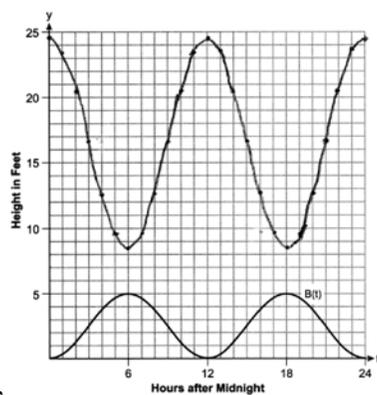
PTS: 4

REF: 082536aaii

NAT: F.BF.A.1

TOP: Operations with Functions

37 ANS:



$$12, B(t) = -2.5 \cos \frac{\pi}{6} t + 2.5, \quad 8.5$$

PTS: 6

REF: 082537aaii

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph