0625aii

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

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

2) $2c^{\frac{3}{4}}$

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

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

2 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

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

1) $x = \dfrac{\log(50)}{19}$

2) $x = \dfrac{\log_2(10)}{19}$

3) $x = \dfrac{\log_2(45)}{19}$

4) $x = \dfrac{5}{19}$

4 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.

5 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

6 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) $-8ix^3 - 3x - ix$

7 Which sequence has a common ratio of $\dfrac{1}{2}$?

1) $-\dfrac{1}{4}a, -\dfrac{1}{8}a, -\dfrac{1}{16}a, -\dfrac{1}{32}a, \dots$

2) $\dfrac{1}{32}a, \dfrac{1}{16}a, \dfrac{1}{8}a, \dfrac{1}{4}a, \dots$

3) $20a, \dfrac{39}{2}a, 19a, \dfrac{37}{2}a, \dots$

4) $22a, 22.5a, 23a, 23.5a, \dots$

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

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

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

3) $2x^2 + 8x - 15 + \dfrac{17}{x+1}$

4) $2x^2 + 8x + 15 - \dfrac{13}{x+1}$

9 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   3) 0.46
2) 0.19   4) 0.96

10 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   3) I and III
2) II, only   4) neither I nor II

11 Josie examines the graphs of $f(x) = 3^x - 8$ and $g(x) = \dfrac{1}{x^2 - 4}$. The number of solutions to $f(x) = g(x)$ is
1) 1   3) 3
2) 2   4) 0

12 Which binomial is a factor of $g^3 + 6g^2 + g - 14$?
1) $g - 1$ 3) $g + 1$
2) $g - 2$ 4) $g + 2$

13 Consider the recursively defined sequence below.

$$a_1 = 8$$

$$a_n = 2a_{n-1}$$

Which explicit formula represents the same sequence?
1) $a_n = 2^n$ 3) $a_n = 2^{n+2}$
2) $a_n = 2(4^n)$ 4) $a_n = 8^n$

14 What is the exact value of $\tan\left(-\dfrac{5\pi}{6}\right)$?

1) $\dfrac{1}{\sqrt{3}}$

3) $\sqrt{3}$

2) $-\dfrac{1}{\sqrt{3}}$

4) $-\sqrt{3}$

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

1) $2m$

3) $\dfrac{m}{2}$

2) $\dfrac{2}{m}$

4) 2^{m}

16 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) $\dfrac{8+x}{x} = 0.90$

3) $\dfrac{8}{10}+x = 0.90$

2) $\dfrac{8}{10+x} = 0.90$

4) $\dfrac{8+x}{10+x} = 0.90$

17 Consider the system of equations below.

$$3x + 2y = 1$$
$$2y + z = 2$$
$$2x - 2z = -6$$

What is the value of x?
1) 1
3) -4
2) -1
4) 4

18 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) $(1,1)$
3) $(3,-7)$
2) $(-2,-2)$
4) $(6,-2)$

19 Which statement best describes the end behavior of the function $y = \log(x-3)$?
1) As $x \to -\infty, y \to -\infty$, and as $x \to \infty, y \to \infty$.
3) As $x \to -\infty, y \to 0$, and as $x \to \infty, y \to \infty$.
2) As $x \to 3, y \to -\infty$, and as $x \to \infty, y \to \infty$.
4) As $x \to 3, y \to 0$, and as $x \to \infty, y \to \infty$.

20 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) $B = 5835.943(1.136938)^{5t}$

21 Which expression or expressions are equal to 0 for all real numbers?

    I. $(x^2 + y^2)^2 + (x^2 + y^2)^2 - 2(x^2 + y^2)^2$

    II. $(x^2 + y^2)^2 - (x^2 + y^2)^2$

    III. $(x^2 + y^2)^2 - (x^2 + y^2)^2 - (2xy)^2$

1) I, only

2) III, only

3) I and II, only

4) I and III, only

22 The equation $\dfrac{1}{x} - \dfrac{1}{5} = \dfrac{x}{5}$ has

1) rational solutions

2) irrational solutions

3) imaginary solutions

4) no solutions

23 For $x \neq \pm 4y$, the expression $\dfrac{x^2 + 3xy - 28y^2}{16y^2 - x^2}$ is equivalent to

1) $-1 - \dfrac{7}{4}y$

2) $\dfrac{x - 7y}{4y - x}$

3) $\dfrac{x + 7y}{x + 4y}$

4) $\dfrac{-x - 7y}{x + 4y}$

24 Which equation represents a parabola with a focus of $(-2, 1)$ and directrix of $y = 5$?

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

2) $(x + 2)^2 = 5(y - 1)$

3) $(x + 2)^2 = -8(y - 1)$

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

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.
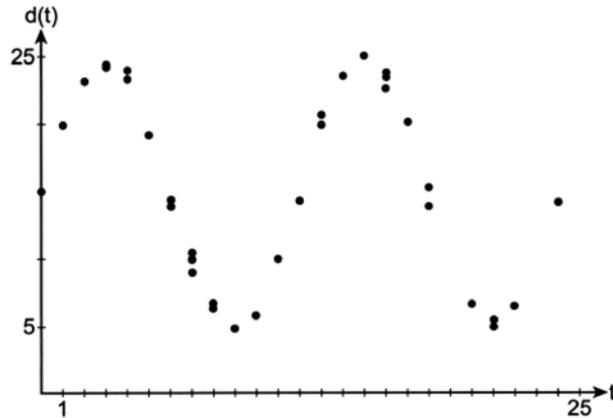
The depth of the water can be modeled with a trigonometric function of the form $d(t) = A \sin\left(\dfrac{\pi}{6} t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

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

27 Factor the expression completely: $(x-1)^2 + 5(x-1) - 6$

28 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.

29   The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.
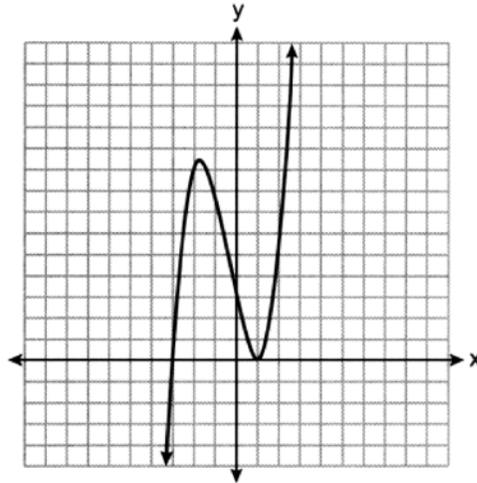
Write an equation for $f(x)$.

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

31   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.
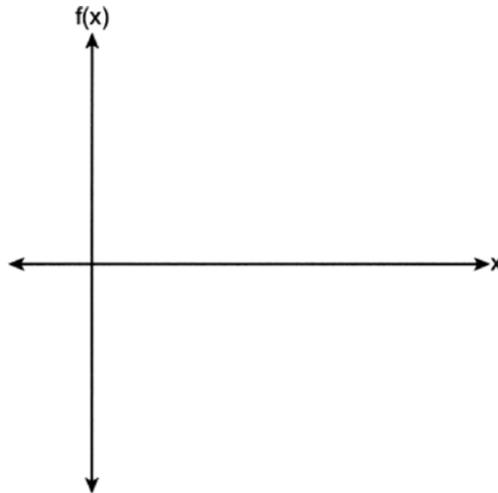
32   In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number 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.

33 Solve algebraically for x: $\dfrac{2}{x} = \dfrac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

34 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.

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

36 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.

37 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.

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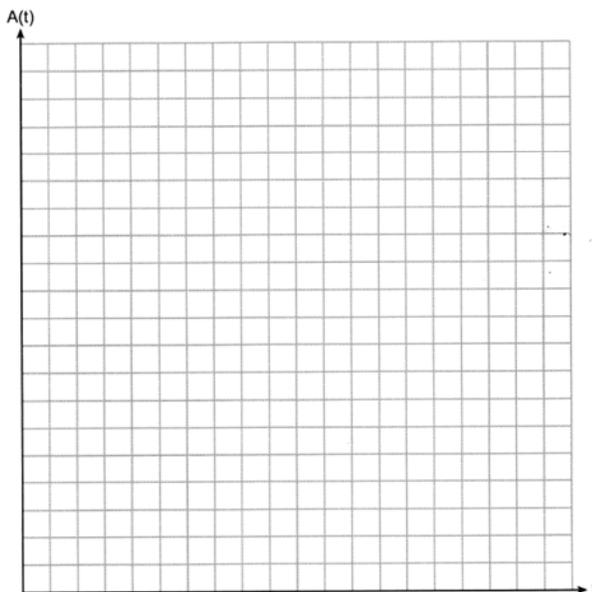
Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*. Explain what this value means in the given context.

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Answer Section

1 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
2 ANS: 3   PTS: 2   REF: 062502aii   NAT: S.IC.B.3
   TOP: Analysis of Data
3 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
4 ANS: 2
   $1 - .965 = .035 = 3.5\%$

PTS: 2   REF: 062504aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions
5 ANS: 2   PTS: 2   REF: 062505aii   NAT: S.IC.B.4
   TOP: Analysis of Data
6 ANS: 3

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

$$2(-i)x^2 + 3(-1)x - ix$$

$$-2ix^2 - 3x - ix$$

PTS: 2   REF: 062506aii   NAT: N.CN.A.2   TOP: Imaginary Numbers
7 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: 062507aii   NAT: F.IF.A.3   TOP: Sequences
   KEY: difference or ratio

8 ANS: 1

$$
\begin{array}{r}
2x^2 + 4x + 3 \\
x + 1 \overline{\smash{\big)}\ 2x^3 + 6x^2 + 7x + 2} \\
\underline{2x^3 + 2x^2} \\
4x^2 + 7x \\
\underline{4x^2 + 4x} \\
3x + 2 \\
\underline{3x + 3} \\
-1
\end{array}
$$

PTS: 2   REF: 062508aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

9 ANS: 3
$.71 + .52 - .77 = .46$

PTS: 2   REF: 062509aii   NAT: S.CP.B.7   TOP: Addition Rule

10 ANS: 1
x-intercept: $f(x) = (x - 2)^2(x + 3) = 0$, $g(x) = 0$ at $x = 2, -3$;
$$x = 2, -3$$
y-intercept: $f(0) = (x - 2)^2(x + 3) = (0 - 2)^2(0 + 3) = 12$, $g(0) = -6$

PTS: 2   REF: 062510aii   NAT: F.IF.C.9   TOP: Comparing Functions

11 ANS: 3
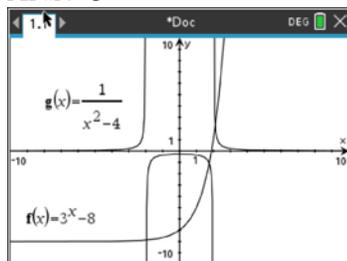
PTS: 2   REF: 062511aii   NAT: A.REI.D.11   TOP: Other Systems
KEY: rational

12 ANS: 4

$$
\begin{array}{r}
-2 \,\big|\ \begin{array}{rrrr} 1 & 6 & 1 & -14 \end{array} \\
\begin{array}{rrrr} & -2 & -8 & 14 \end{array} \\
\hline
\begin{array}{rrrr} 1 & 4 & -7 & 0 \end{array}
\end{array}
$$

Since there is no remainder when the cubic is divided by $g + 2$, this binomial is a factor.

PTS: 2   REF: 062512aii   NAT: A.APR.B.2   TOP: Remainder and Factor Theorems

13 ANS: 3 PTS: 2 REF: 062513aii NAT: F.BF.A.2
TOP: Sequences KEY: recursive

14 ANS: 1 PTS: 2 REF: 062514aii NAT: F.TF.A.2
TOP: Determining Trigonometric Functions KEY: radians

15 ANS: 1

$$\frac{n}{m} = 2$$

$$n = 2m$$

PTS: 2 REF: 062515aii NAT: F.LE.A.4 TOP: Exponential Equations

16 ANS: 4 PTS: 2 REF: 062516aii NAT: A.CED.A.1
TOP: Modeling Rationals

17 ANS: 1

$$2y + z = 2 \rightarrow y = \frac{2-z}{2} \qquad 3x + 2\left(\frac{2-z}{2}\right) = 1 \quad 3x - (x+3) = -1$$

$$2x - 2z = -6 \rightarrow x - z = -3 \rightarrow z = x + 3 \qquad 3x + 2 - z = 1 \qquad 2x = 2$$

$$3x - z = -1 \qquad x = 1$$

PTS: 2 REF: 062517aii NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables

18 ANS: 4
$(2 + 4, -3 + 1)$

PTS: 2 REF: 062518aii NAT: F.BF.B.3 TOP: Transformations with Functions

19 ANS: 2
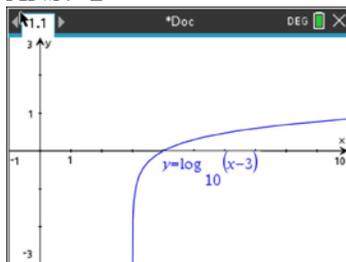
PTS: 2 REF: 062519aii NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

20 ANS: 3

$$\left((1.026)^5\right)^{\frac{t}{5}} \approx 1.136938^{\frac{t}{5}}$$

PTS: 2 REF: 062520aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

21 ANS: 4

I. $(x^2+y^2)^2+(x^2+y^2)^2-2(x^2+y^2)^2=2(x^2+y^2)^2-2(x^2+y^2)^2=0$

II. $(x^2+y^2)^2-(x^2-y^2)^2=x^4+2x^2y^2+y^4-(x^4-2x^2y^2+y^4)=4x^2y^2$

III. $(x^2+y^2)^2-(x^2+y^2)^2-(2xy)^2==x^4+2x^2y^2+y^4-(x^4-2x^2y^2+y^4)-4x^2y^2=0$

PTS: 2   REF: 062521aii   NAT: A.APR.C.4   TOP: Polynomial Identities

22 ANS: 2

$\dfrac{1}{x}-\dfrac{1}{5}=\dfrac{x}{5}$ $b^2-4ac=1^2-4(1)(-5)=1+20=21$, which is not a perfect square.

$\dfrac{1}{x}=\dfrac{x+1}{5}$

$x^2+x=5$

$x^2+x-5=0$

PTS: 2   REF: 062522aii   NAT: A.REI.A.2   TOP: Solving Rationals

23 ANS: 1

$\dfrac{x^2+3xy-28y^2}{16y^2-x^2}=\dfrac{(x+7y)(x-4y)}{(4y+x)(4y-x)}=\dfrac{-(x+7y)}{4y+x}=\dfrac{-x-7y}{x+4y}$

PTS: 2   REF: 062523aii   NAT: A.APR.D.6   TOP: Rational Expressions

KEY: factoring

24 ANS: 1

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

$y=-\dfrac{1}{4(2)}(x+2)^2+3$

$y-3=-\dfrac{1}{8}(x+2)^2$

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

PTS: 2   REF: 062524aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

25 ANS:

$\dfrac{25-5}{2}=10$

PTS: 2   REF: 062525aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions

KEY: amplitude

26 ANS:

$$\sqrt{x-2} = 4-x \qquad \text{6 is extraneous.}$$

$$x - 2 = 16 - 8x + x^2$$

$$0 = x^2 - 9x + 18$$

$$0 = (x-6)(x-3)$$

$$x = 6, 3$$

PTS: 2   REF: 062526aii   NAT: A.REI.A.2   TOP: Solving Radicals

27 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

28 ANS:

$$\frac{94}{87+94+21} = \frac{94}{202}$$

PTS: 2   REF: 062528aii   NAT: S.CP.A.4   TOP: Conditional Probability

29 ANS:

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

PTS: 2   REF: 062529aii   NAT: A.APR.B.3   TOP: Graphing Polynomial Functions

30 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: 062530aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: linear

31 ANS:
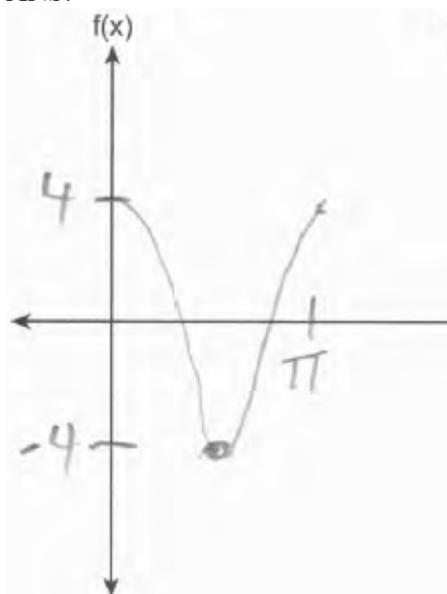
PTS: 2   REF: 062531aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

32 ANS:

$.705 \pm 2(.045)$ No, because .67 falls within the confidence interval.

   $.615 - .795$

PTS: 2   REF: 062532aii   NAT: S.IC.A.2   TOP: Analysis of Data

33 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: 062533aii   NAT: A.REI.A.2   TOP: Solving Rationals

34 ANS:

$750 \mp 2(20)$ $50\% + 19.1\% \approx 69\%$

   $710 - 790$

PTS: 4   REF: 062534aii   NAT: S.ID.A.4   TOP: Normal Distributions

35 ANS:

$$(3x^2 - 4x + 7)(x - 2) - (x - 2)^3$$

$$3x^3 - 6x^2 - 4x^2 + 8x + 7x - 14 - (x^3 - 6x^2 + 12x - 8)$$

$$3x^3 - 10x^2 + 15x - 14 - x^3 + 6x^2 - 12x + 8$$

$$2x^3 - 4x^2 + 3x - 6$$

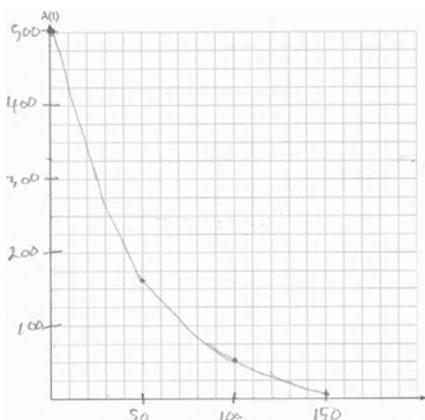PTS: 4   REF: 062535aii   NAT: F.BF.A.1   TOP: Operations with Functions

36 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

37 ANS:

$125 = 500e^{k(60.34)}$ $A(t) = 500e^{-.023t}$ $\dfrac{A(60) - A(0)}{60 - 0} \approx -6.2$ The mass of

$k \approx -.023$

Cesium-137 decreases about 6.2 grams per year.

PTS: 6   REF: 062537aii   NAT: F.LE.A.4   TOP: Exponential Decay