

**Algebra II Common Core State Standards Regents Bimodal Worksheets**

- 1 Which equation represents a parabola with the focus at  $(0, -1)$  and the directrix of  $y = 1$ ?
  
- 2 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.

- 3 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?

- 4 Factored completely,  $m^5 + m^3 - 6m$  is equivalent to

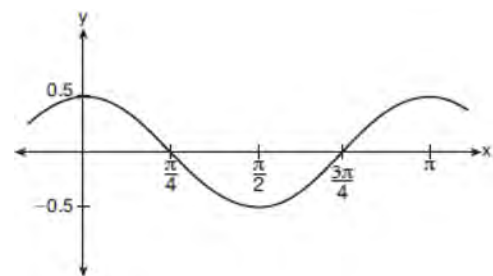
- 5 The set of data in the table below shows the results of a survey on the number of messages that people of different ages text on their cell phones each month.

Age Group	Text Messages per Month		
	0-10	11-50	Over 50
15-18	4	37	68
19-22	6	25	87
23-60	25	47	157

If a person from this survey is selected at random, what is the probability that the person texts over 50 messages per month given that the person is between the ages of 23 and 60?

- 6 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?

- 7 Which equation is represented by the graph shown below?



- 8 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value,  $V$ , of his car after  $t$  years can be modeled by the equation  $\log_{0.8}\left(\frac{V}{17000}\right) = t$ . What is the average decreasing rate of change per year of the value of the car from June 2012 to June 2014, to the *nearest ten dollars per year*?
- 9 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
- 10 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?
- 11 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
- 12 Given  $f^{-1}(x) = -\frac{3}{4}x + 2$ , which equation represents  $f(x)$ ?
- 13 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?
- 14 Given  $i$  is the imaginary unit,  $(2 - yi)^2$  in simplest form is
- 15 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.
- 16 What is the quotient when  $10x^3 - 3x^2 - 7x + 3$  is divided by  $2x - 1$ ?
- 17 The expression  $\frac{6x^3 + 17x^2 + 10x + 2}{2x + 3}$  equals
- 18 The zeros for  $f(x) = x^4 - 4x^3 - 9x^2 + 36x$  are

- 19 The expression  $\frac{x^3 + 2x^2 + x + 6}{x + 2}$  is equivalent to
- 20 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?
- 21 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?
- 22 A parabola has its focus at (1,2) and its directrix is  $y = -2$ . The equation of this parabola could be
- 23 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
- 24 The solution to the equation  $4x^2 + 98 = 0$  is
- 25 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?
- 26 What are the zeros of  $P(m) = (m^2 - 4)(m^2 + 1)$ ?
- 27 What is the solution, if any, of the equation  $\frac{2}{x+3} - \frac{3}{4-x} = \frac{2x-2}{x^2-x-12}$ ?
- 28 What is the equation of the directrix for the parabola  $-8(y - 3) = (x + 4)^2$ ?
- 29 What is the completely factored form of  $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$ ?
- 30 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

31 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?

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

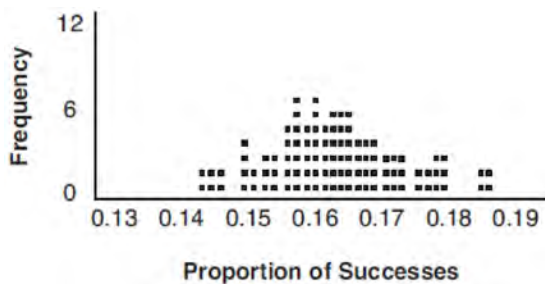
32 What is the solution set for  $x$  in the equation below?

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

36 The sequence  $a_1 = 6, a_n = 3a_{n-1}$  can also be written as

33 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.

37 A circle centered at the origin has a radius of 10 units. The terminal side of an angle,  $\theta$ , intercepts the circle in Quadrant II at point  $C$ . The  $y$ -coordinate of point  $C$  is 8. What is the value of  $\cos \theta$ ?



38 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

At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to

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

34 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?

40 The solutions to  $x + 3 - \frac{4}{x-1} = 5$  are

41 To the *nearest tenth*, the value of  $x$  that satisfies  $2^x = -2x + 11$  is

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

43 If the terminal side of angle  $\theta$ , in standard position, passes through point  $(-4, 3)$ , what is the numerical value of  $\sin \theta$ ?

44 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?

45 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

46 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?

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

48 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.  $x^{-\frac{1}{6}}$

49 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?

50 Mr. Farison gave his class the three mathematical rules shown below to either prove or disprove. Which rules can be proved for all real numbers?

I  $(m + p)^2 = m^2 + 2mp + p^2$

II  $(x + y)^3 = x^3 + 3xy + y^3$

III  $(a^2 + b^2)^2 = (a^2 - b^2)^2 + (2ab)^2$

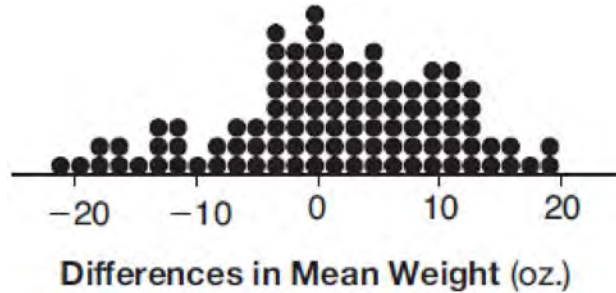
51 For the system shown below, what is the value of  $z$ ?

$$y = -2x + 14$$

$$3x - 4z = 2$$

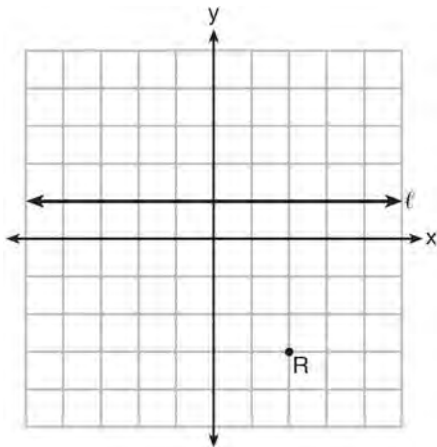
$$3x - y = 16$$

- 52 Gabriel performed an experiment to see if planting 13 tomato plants in black plastic mulch leads to larger tomatoes than if 13 plants are planted without mulch. He observed that the average weight of the tomatoes from tomato plants grown in black plastic mulch was 5 ounces greater than those from the plants planted without mulch. To determine if the observed difference is statistically significant, he rerandomized the tomato groups 100 times to study these random differences in the mean weights. The output of his simulation is summarized in the dotplot below.



Given these results, what is an appropriate inference that can be drawn?

- 53 Which equation represents the set of points equidistant from line  $\ell$  and point  $R$  shown on the graph below?



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

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

- 57 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?

- 54 If  $p(x) = 2x^3 - 3x + 5$ , what is the remainder of  $p(x) \div (x - 5)$ ?

- 58 Which diagram represents an angle,  $\alpha$ , measuring  $\frac{13\pi}{20}$  radians drawn in standard position, and its reference angle,  $\theta$ ?

59 A recursive formula for the sequence 18, 9, 4.5, ... is

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

61 The solution set for the equation  $\sqrt{x+14} - \sqrt{2x+5} = 1$  is

62 Given  $f(9) = -2$ , which function can be used to generate the sequence  $-8, -7.25, -6.5, -5.75, \dots$ ?

63 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  $H(t) = 70 \sin\left(\frac{2\pi}{7}(t - 1.75)\right) + 80$ , where  $t$  is time, in minutes. Using  $H(t)$  for one full rotation, this car's minimum height, in feet, is

64 Relative to the graph of  $y = 3 \sin x$ , what is the shift of the graph of  $y = 3 \sin\left(x + \frac{\pi}{3}\right)$ ?

65 Which diagram shows an angle rotation of 1 radian on the unit circle?

66 If  $\sin^2(32^\circ) + \cos^2(M) = 1$ , then  $M$  equals

67 Which equation represents a parabola with a focus of  $(0, 4)$  and a directrix of  $y = 2$ ?

68 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

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

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

71 The expression  $6xi^3(-4xi + 5)$  is equivalent to

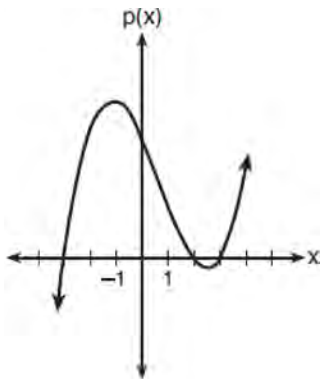
72 The expression  $\frac{4x^3 + 5x + 10}{2x + 3}$  is equivalent to

- 73 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  $1.0 \times 10^{-12}$  W/m<sup>2</sup> (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  $6.3 \times 10^{-3}$  W/m<sup>2</sup> be classified?

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



Which equation could represent  $p(x)$ ?

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

- 77 If  $p(x) = ab^x$  and  $r(x) = cd^x$ , then  $p(x) \cdot r(x)$  equals

- 78 The terminal side of  $\theta$ , an angle in standard position, intersects the unit circle at  $P\left(-\frac{1}{3}, -\frac{\sqrt{8}}{3}\right)$ .

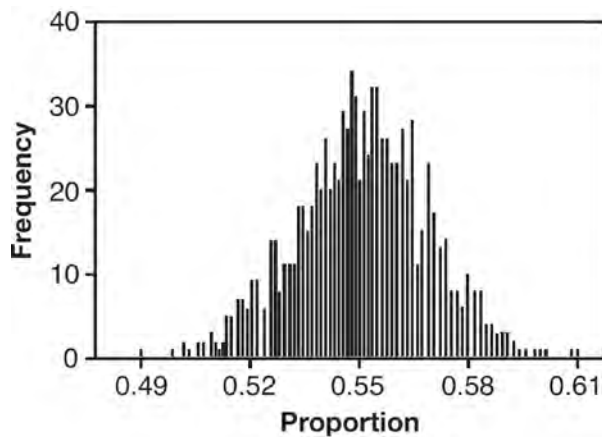
What is the value of  $\sec \theta$ ?

- 75 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?

- 79 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?



- 80 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

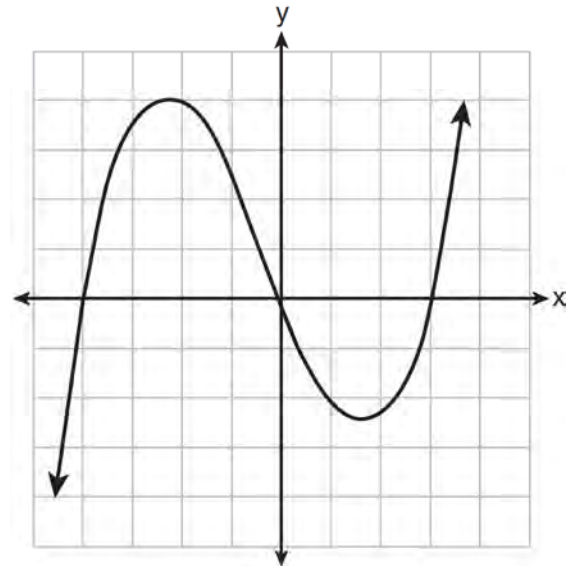
- 81 A polynomial equation of degree three,  $p(x)$ , is used to model the volume of a rectangular box. The graph of  $p(x)$  has  $x$  intercepts at  $-2$ ,  $10$ , and  $14$ . Which statements regarding  $p(x)$  could be true?
- A. The equation of  $p(x) = (x - 2)(x + 10)(x + 14)$ .
  - B. The equation 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.

- 82 Given that  $\sin^2 \theta + \cos^2 \theta = 1$  and  $\sin \theta = -\frac{\sqrt{2}}{5}$ , what is a possible value of  $\cos \theta$ ?

- 83 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?

- 84 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?

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



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

- 86 What is the solution to  $8(2^{x+3}) = 48$ ?

87 For which values of  $x$ , rounded to the *nearest hundredth*, will  $|x^2 - 9| - 3 = \log_3 x$ ?

88 The completely factored form of  $2d^4 + 6d^3 - 18d^2 - 54d$  is

89 The probability that Gary and Jane have a child with blue eyes is 0.25, and the probability that they have a child with blond hair is 0.5. The probability that they have a child with both blue eyes and blond hair is 0.125. Given this information, the events blue eyes and blond hair are

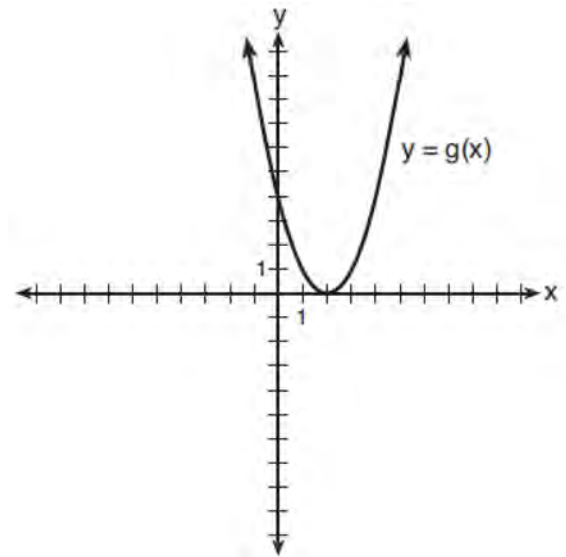
- I: dependent
- II: independent
- III: mutually exclusive

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

91 The function  $f(x) = \frac{x - 3}{x^2 + 2x - 8}$  is undefined when  $x$  equals

92 Pedro and Bobby each own an ant farm. Pedro starts with 100 ants and says his farm is growing exponentially at a rate of 15% per month. Bobby starts with 350 ants and says his farm is steadily decreasing by 5 ants per month. Assuming both boys are accurate in describing the population of their ant farms, after how many months will they both have approximately the same number of ants?

93 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?



94 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.]

95 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?

- 96 Which expression is equivalent to  $(3k - 2i)^2$ , where  $i$  is the imaginary unit?
- 97 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of  $\frac{2\pi}{3}$ ?
- 98 What is the solution set of the equation  $\frac{3x + 25}{x + 7} - 5 = \frac{3}{x}$ ?
- 99 If  $ae^{bt} = c$ , where  $a$ ,  $b$ , and  $c$  are positive, then  $t$  equals
- 100 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
- 101 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?
- 102 The Rickerts decided to set up an account for their daughter to pay for her college education. The day their daughter was born, they deposited \$1000 in an account that pays 1.8% compounded annually. Beginning with her first birthday, they deposit an additional \$750 into the account on each of her birthdays. Which expression correctly represents the amount of money in the account  $n$  years after their daughter was born?

## Algebra II Common Core State Standards Regents Bimodal Worksheets Answer Section

1 ANS:

$$x^2 = -4y$$

The vertex of the parabola is (0,0). The distance,  $p$ , between the vertex and the focus or the vertex and the directrix is 1.  $y = \frac{-1}{4p}(x-h)^2 + k$

$$y = \frac{-1}{4(1)}(x-0)^2 + 0$$

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

PTS: 2 REF: 081706aai TOP: Graphing Quadratic Functions

2 ANS:

I, only

II. Ninth graders drive to school less often; III. Students know little about adults; IV. Calculus students love math!

PTS: 2 REF: 081602aai TOP: Analysis of Data

KEY: bias

3 ANS:

$$A = 100(0.990656)^t$$

$$\left(\frac{1}{2}\right)^{\frac{1}{73.83}} \approx 0.990656$$

PTS: 2 REF: 081710aai TOP: Modeling Exponential Functions

KEY: AII

4 ANS:

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

$$m^5 + m^3 - 6m = m(m^4 + m^2 - 6) = m(m^2 + 3)(m^2 - 2)$$

PTS: 2 REF: 011703aai TOP: Factoring Polynomials

KEY: higher power AII

5 ANS:

$$\frac{157}{229}$$

$$\frac{157}{25 + 47 + 157}$$

PTS: 2 REF: 081607aai TOP: Conditional Probability

6 ANS:  
-0.26

$$\frac{f(7) - f(-7)}{7 - (-7)} = \frac{2^{-0.25(7)} \cdot \sin\left(\frac{\pi}{2}(7)\right) - 2^{-0.25(-7)} \cdot \sin\left(\frac{\pi}{2}(-7)\right)}{14} \approx -0.26$$

PTS: 2 REF: 061721aii TOP: Rate of Change  
KEY: AII

7 ANS:

$$y = \frac{1}{2} \cos 2x$$

PTS: 2 REF: 061708aii TOP: Graphing Trigonometric Functions  
KEY: identify

8 ANS:  
2450

$$\log_{0.8}\left(\frac{V}{17000}\right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3 - 1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

PTS: 2 REF: 081709aii TOP: Rate of Change  
KEY: AII

9 ANS:  
48



$\bar{x} + 2\sigma$  represents approximately 48% of the data.

PTS: 2 REF: 061609aii TOP: Normal Distributions  
KEY: percent

10 ANS:  
56

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2 REF: 011702aii TOP: Modeling Exponential Functions  
KEY: AII

11 ANS:

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

$$B(t) = 750 \left( 1.16^{\frac{1}{12}} \right)^{12t} \approx 750(1.012)^{12t} \quad B(t) = 750 \left( 1 + \frac{0.16}{12} \right)^{12t} \text{ is wrong, because the growth is an annual rate}$$

that is not compounded monthly.

PTS: 2

REF: spr1504aii

TOP: Modeling Exponential Functions

KEY: AII

12 ANS:

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

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

$$-4x = 3y - 8$$

$$-4x + 8 = 3y$$

$$-\frac{4}{3}x + \frac{8}{3} = y$$

PTS: 2

REF: 061616aii

TOP: Inverse of Functions

KEY: equations

13 ANS:

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

PTS: 2

REF: 081622aii

TOP: Modeling Exponential Functions

KEY: AII

14 ANS:

$$-y^2 - 4yi + 4$$

$$(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$$

PTS: 2

REF: 061603aii

TOP: Operations with Complex Numbers

15 ANS:

$$C(n) = \frac{329.99 + 108.78n}{n}$$

PTS: 2

REF: 061722aii

TOP: Modeling Rationals

16 ANS:

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

$$2x - 1 \overline{) 10x^3 - 3x^2 - 7x + 3}$$

$$\underline{10x^3 - 5x^2}$$

$$2x^2 - 7x$$

$$\underline{2x^2 - x}$$

$$-6x + 3$$

$$\underline{-6x + 3}$$

PTS: 2

REF: 011809aaii

TOP: Rational Expressions

17 ANS:

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

$$2x + 3 \overline{) 6x^3 + 17x^2 + 10x + 2}$$

$$\underline{6x^3 + 9x^2}$$

$$8x^2 + 10x$$

$$\underline{8x^2 + 12x}$$

$$-2x + 2$$

$$\underline{-2x - 3}$$

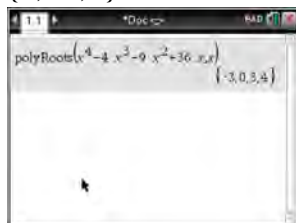
$$5$$

PTS: 2

REF: fall1503aaii

TOP: Rational Expressions

18 ANS:

 $\{0, \pm 3, 4\}$ 

$$x^4 - 4x^3 - 9x^2 + 36x = 0$$

$$x^3(x - 4) - 9x(x - 4) = 0$$

$$(x^3 - 9x)(x - 4) = 0$$

$$x(x^2 - 9)(x - 4) = 0$$

$$x(x + 3)(x - 3)(x - 4) = 0$$

$$x = 0, \pm 3, 4$$

PTS: 2

REF: 061606aaii

TOP: Zeros of Polynomials

KEY: All

19 ANS:

$$\begin{array}{r}
 x^2 + 1 + \frac{4}{x+2} \\
 \frac{x^2 + 0x + 1}{x+2} \overline{) x^3 + 2x^2 + x + 6} \\
 \underline{x^3 + 2x^2} \\
 0x^2 + x \\
 \underline{0x^2 + 0x} \\
 x + 6 \\
 \underline{x + 2} \\
 4
 \end{array}$$

PTS: 2 REF: 081611aii TOP: Rational Expressions

20 ANS:

\$17,433,922.00

$$S_{20} = \frac{.01 - .01(3)^{20}}{1 - 3} = 17,433,922$$

PTS: 2 REF: 011822aii TOP: Series

21 ANS:

$$a_1 = 25,000, a_n = a_{n-1} + 1000$$

PTS: 2 REF: 011824aii TOP: Sequences

22 ANS:

$$y = \frac{1}{8}(x-1)^2$$

The vertex is (1,0) and  $p = 2$ .  $y = \frac{1}{4(2)}(x-1)^2 + 0$

PTS: 2 REF: 061717aii TOP: Graphing Quadratic Functions

23 ANS:

II, only

The 2010 population is 110 million.

PTS: 2 REF: 061718aii TOP: Modeling Exponential Functions



24 ANS:

$$\pm \frac{7i\sqrt{2}}{2}$$

$$4x^2 = -98$$

$$x^2 = -\frac{98}{4}$$

$$x^2 = -\frac{49}{2}$$

$$x = \pm \sqrt{-\frac{49}{2}} = \pm \frac{7i}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \pm \frac{7i\sqrt{2}}{2}$$

PTS: 2 REF: 061707aai TOP: Solving Quadratics

KEY: complex solutions | taking square roots

25 ANS:

$$V = 120 \sin(120\pi t)$$

$$\text{period} = \frac{2\pi}{B}$$

$$\frac{1}{60} = \frac{2\pi}{B}$$

$$B = 120\pi$$

PTS: 2 REF: 061624aai TOP: Modeling Trigonometric Functions

26 ANS:

2, -2,  $i$ , and  $-i$ 

PTS: 2 REF: 081708aai TOP: Zeros of Polynomials

KEY: All

27 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 TOP: Solving Rationals

KEY: rational solutions

28 ANS:

$$y = 5$$

In vertex form, the parabola is  $y = -\frac{1}{4(2)}(x+4)^2 + 3$ . The vertex is  $(-4, 3)$  and  $p = 2$ .  $3 + 2 = 5$

PTS: 2 REF: 011816aai TOP: Graphing Quadratic Functions

29 ANS:

$$(k+2)(k-2)(k+6)(k+2)$$

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$$

$$k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)$$

$$(k^2 - 4)(k^2 + 8k + 12)$$

$$(k+2)(k-2)(k+6)(k+2)$$

PTS: 2 REF: fall1505aii TOP: Factoring Polynomials

KEY: factoring by grouping

30 ANS:

$$P = 714(0.9716)^y$$

$$0.75^{\frac{1}{10}} \approx .9716$$

PTS: 2 REF: 061713aii TOP: Modeling Exponential Functions

KEY: All

31 ANS:

$$496 \pm 230$$

$$496 \pm 2(115)$$

PTS: 2 REF: 011718aii TOP: Normal Distributions

KEY: interval

32 ANS:

$$\{-1, 0\}$$

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

$$x+1 = x^2 + 2x + 1$$

$$0 = x^2 + x$$

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

$$x = -1, 0$$

PTS: 2 REF: 011802aii TOP: Solving Radicals

KEY: extraneous solutions

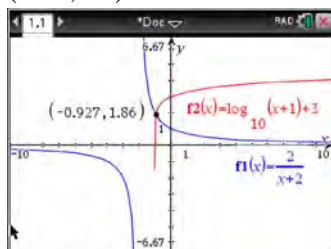
33 ANS:

proportion  $\approx .16$ ; margin of error  $\approx .02$ 

$$ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.16)(0.84)}{1334}} \right) \approx 0.02$$

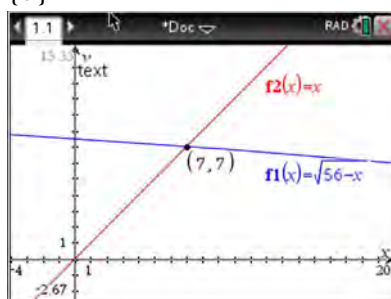
PTS: 2 REF: 081716aii TOP: Analysis of Data

- 34 ANS:  
 (-0.9, 1.9)



PTS: 2 REF: 011712aai TOP: Other Systems  
 KEY: All

- 35 ANS:  
 {7}



$$\sqrt{56-x} = x \quad -8 \text{ is extraneous.}$$

$$56-x = x^2$$

$$0 = x^2 + x - 56$$

$$0 = (x+8)(x-7)$$

$$x = 7$$

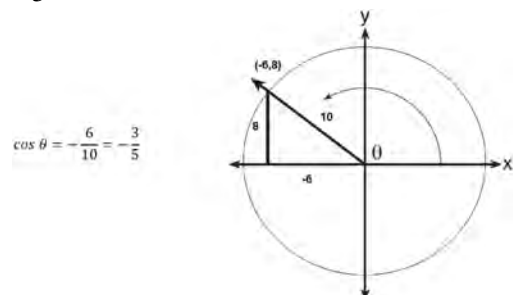
PTS: 2 REF: 061605aai TOP: Solving Radicals  
 KEY: extraneous solutions

- 36 ANS:  
 $a_n = 2 \cdot 3^n$

PTS: 2 REF: 081618aai TOP: Sequences

37 ANS:

$$-\frac{3}{5}$$



PTS: 2

REF: 061617aai

TOP: Determining Trigonometric Functions

KEY: extension to reals

38 ANS:

$$\frac{FW}{W-F}$$

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

$$\frac{1}{J} = \frac{W-F}{FW}$$

$$J = \frac{FW}{W-F}$$

PTS: 2

REF: 081617aai

TOP: Solving Rationals

KEY: rational solutions

39 ANS:

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

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

$$xy - 2x = y + 1$$

$$xy - y = 2x + 1$$

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

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

PTS: 2

REF: 081714aai

TOP: Inverse of Functions

KEY: equations

40 ANS:

$$\frac{3 \pm \sqrt{17}}{2}$$

$$x - \frac{4}{x-1} = 2 \quad x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2}$$

$$x(x-1) - 4 = 2(x-1)$$

$$x^2 - x - 4 = 2x - 2$$

$$x^2 - 3x - 2 = 0$$

PTS: 2

REF: 011812aai

TOP: Solving Rationals

KEY: rational solutions

41 ANS:

2.6



PTS: 2

REF: 081603aai

TOP: Other Systems

KEY: All

42 ANS:

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

$$x = -6(y - 2)$$

$$-\frac{x}{6} = y - 2$$

$$-\frac{x}{6} + 2 = y$$

PTS: 2

REF: 011821aai

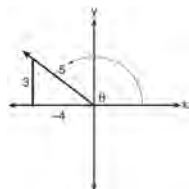
TOP: Inverse of Functions

KEY: equations

43 ANS:

$$\frac{3}{5}$$

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 TOP: Determining Trigonometric Functions  
KEY: extension to reals

44 ANS:

149

$$d = 32(.8)^{b-1} \quad S_n = \frac{32 - 32(.8)^{12}}{1 - .8} \approx 149$$

PTS: 2 REF: 081721aii TOP: Series

45 ANS:

$$-0.15x^3 - 0.02x^2 + 28x - 120$$

$$\begin{aligned} x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) &= 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120 \\ &= -0.15x^3 - 0.02x^2 + 28x - 120 \end{aligned}$$

PTS: 2 REF: 061709aii TOP: Operations with Functions

46 ANS:

$$300e^{-0.87}$$

$$\frac{A}{P} = e^{rt}$$

$$0.42 = e^{rt}$$

$$\ln 0.42 = \ln e^{rt}$$

$$-0.87 \approx rt$$

PTS: 2 REF: 011723aii TOP: Modeling Exponential Functions

KEY: All

47 ANS:

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

$$\frac{c^2 - d^2}{d^2 + cd - 2c^2} = \frac{(c+d)(c-d)}{(d+2c)(d-c)} = \frac{-(c+d)}{d+2c} = \frac{-c-d}{d+2c}$$

PTS: 2 REF: 011818aii TOP: Rational Expressions

KEY:  $a > 0$

48 ANS:  
I, II, and III

PTS: 2 REF: 061716aai TOP: Radicals and Rational Exponents  
KEY: variables

49 ANS:  
$$\frac{255 + 93T}{T + 3} = 90$$

PTS: 2 REF: 061602aai TOP: Modeling Rationals

50 ANS:  
I and III  
$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3$$

PTS: 2 REF: 081620aai TOP: Polynomial Identities

51 ANS:  
4  
$$3x - (-2x + 14) = 16 \quad 3(6) - 4z = 2$$
  
$$5x = 30 \quad -4z = -16$$
  
$$x = 6 \quad z = 4$$

PTS: 2 REF: 011803aai TOP: Solving Linear Systems  
KEY: three variables

52 ANS:  
There was an effect observed that could be due to the random assignment of plants to the groups.

PTS: 2 REF: 011709aai TOP: Analysis of Data

53 ANS:  
$$y = -\frac{1}{8}(x - 2)^2 - 1$$

The vertex is  $(2, -1)$  and  $p = 2$ .  $y = -\frac{1}{4(2)}(x - 2)^2 - 1$

PTS: 2 REF: 081619aai TOP: Graphing Quadratic Functions

54 ANS:  
240  
$$p(5) = 2(5)^3 - 3(5) + 5 = 240$$

PTS: 2 REF: 011819aai TOP: Remainder Theorem

55 ANS:

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

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(6)(29)}}{2(6)} = \frac{8 \pm \sqrt{-632}}{12} = \frac{8 \pm i\sqrt{4}\sqrt{158}}{12} = \frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$$

PTS: 2 REF: 011711aii TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

56 ANS:

$$y = 3^x$$

PTS: 2 REF: 011708aii TOP: Inverse of Functions

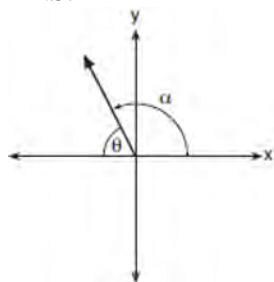
KEY: equations

57 ANS:

left  $a$  units, down  $b$  units

PTS: 2 REF: 061706aii TOP: Graphing Trigonometric Functions

58 ANS:



PTS: 2 REF: 081707aii TOP: Reference Angles

59 ANS:

$$g_1 = 18$$

$$g_n = \frac{1}{2}g_{n-1}$$

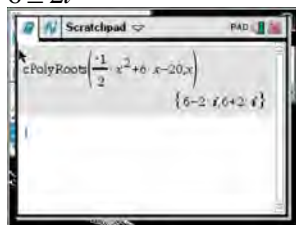
(2) is not recursive

PTS: 2 REF: 081608aii TOP: Sequences



60 ANS:

$6 \pm 2i$



$$-2\left(-\frac{1}{2}x^2 = -6x + 20\right)$$

$$x^2 - 12x = -40$$

$$x^2 - 12x + 36 = -40 + 36$$

$$(x - 6)^2 = -4$$

$$x - 6 = \pm 2i$$

$$x = 6 \pm 2i$$

PTS: 2 REF: fall1504aia TOP: Solving Quadratics

KEY: complex solutions | completing the square

61 ANS:

$\{2\}$

$$\sqrt{x+14} = \sqrt{2x+5} + 1 \qquad \sqrt{22+14} - \sqrt{2(22)+5} = 1$$

$$x+14 = 2x+5+2\sqrt{2x+5}+1 \qquad 6-7 \neq 1$$

$$-x+8 = 2\sqrt{2x+5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x-22)(x-2) = 0$$

$$x = 2, 22$$

PTS: 2 REF: 081704aia TOP: Solving Radicals

KEY: advanced

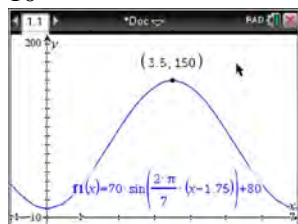
62 ANS:

$$f(n) = -8.75 + 0.75n$$

PTS: 2 REF: 061720aia TOP: Sequences KEY: All

63 ANS:

10



$H(t)$  is at a minimum at  $70(-1) + 80 = 10$

PTS: 2

REF: 061613aai

TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

64 ANS:

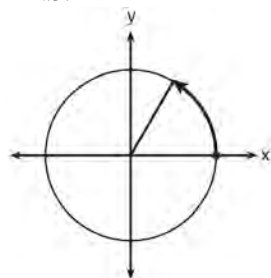
 $\frac{\pi}{3}$  left

PTS: 2

REF: 011701aai

TOP: Graphing Trigonometric Functions

65 ANS:



PTS: 2

REF: 081616aai

TOP: Unit Circle

66 ANS:

 $32^\circ$ 

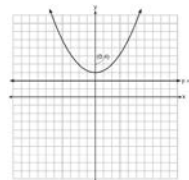
PTS: 2

REF: 011704aai

TOP: Simplifying Trigonometric Expressions

67 ANS:

$$y = \frac{x^2}{4} + 3$$



A parabola with a focus of  $(0,4)$  and a directrix of  $y = 2$  is sketched as follows: By inspection, it is determined that the vertex of the parabola is  $(0,3)$ . It is also evident that the distance,  $p$ , between the vertex and the focus is 1. It is possible to use the formula  $(x - h)^2 = 4p(y - k)$  to derive the equation of the parabola as follows:  $(x - 0)^2 = 4(1)(y - 3)$

$$x^2 = 4y - 12$$

$$x^2 + 12 = 4y$$

$$\frac{x^2}{4} + 3 = y$$

or A point  $(x,y)$  on the parabola must be the same distance from the focus as it is from the directrix. For any such point  $(x,y)$ , the distance to the focus is  $\sqrt{(x-0)^2 + (y-4)^2}$  and the distance to the directrix is  $y - 2$ . Setting this equal leads to:  $x^2 + y^2 - 8y + 16 = y^2 - 4y + 4$

$$x^2 + 16 = 4y + 4$$

$$\frac{x^2}{4} + 3 = y$$

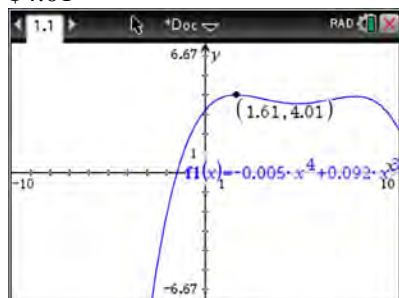
PTS: 2

REF: spr1502aii

TOP: Graphing Quadratic Functions

68 ANS:

\$4.01



PTS: 2

REF: 011817aii

TOP: Graphing Polynomial Functions

69 ANS:

$$2x^2 + x + 5$$

$$2x-1 \overline{) 4x^3 + 0x^2 + 9x - 5}$$

$$\underline{4x^3 - 2x^2}$$

$$2x^2 + 9x$$

$$\underline{2x^2 - x}$$

$$10x - 5$$

$$\underline{10x - 5}$$

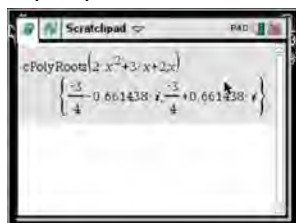
PTS: 2

REF: 081713a

TOP: Rational Expressions

70 ANS:

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



$$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(2)}}{2(2)} = \frac{-3 \pm \sqrt{-7}}{4} = -\frac{3}{4} \pm \frac{i\sqrt{7}}{4}$$

PTS: 2

REF: 061612a

TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

71 ANS:

$$-24x^2 - 30xi$$

$$6xi^3(-4xi + 5) = -24x^2i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi$$

PTS: 2

REF: 061704a

TOP: Operations with Complex Numbers

72 ANS:

$$2x^2 - 3x + 7 - \frac{11}{2x+3}$$

$$2x+3 \overline{) 4x^3 + 0x^2 + 5x + 10}$$

$$\underline{4x^3 + 6x^2}$$

$$-6x^2 + 5x$$

$$\underline{-6x^2 - 9x}$$

$$14x + 10$$

$$\underline{14x + 21}$$

$$-11$$

PTS: 2 REF: 061614aai TOP: Rational Expressions

73 ANS:

very loud

$$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

PTS: 2 REF: 011715aai TOP: Evaluating Logarithmic Expressions

74 ANS:

$$p(x) = (x^2 - 9)(x - 2)$$

PTS: 2 REF: 061701aai TOP: Zeros of Polynomials

KEY: AII

75 ANS:

0.8415



PTS: 2 REF: 081604aai TOP: Normal Distributions

KEY: probability

76 ANS:

$$-1 + 2i \text{ and } -1 - 2i$$

$$x^2 + 2x + 1 = -5 + 1$$

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

$$x + 1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2 REF: 081703aai TOP: Solving Quadratics

KEY: complex solutions | completing the square

77 ANS:

$$ac(bd)^x$$

PTS: 2 REF: 011710aai TOP: Operations with Functions

78 ANS:

$$-3$$

PTS: 2 REF: 011815aai TOP: Unit Circle

79 ANS:

$$j_1 = 250,000$$

$$j_n = 1.00375j_{n-1}$$

PTS: 2 REF: 061623aai TOP: Sequences

80 ANS:

$$0.03$$

$$ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \right) \approx 0.03$$

PTS: 2 REF: 081612aai TOP: Analysis of Data

81 ANS:

*B* and *D*

The maximum volume of  $p(x) = -(x + 2)(x - 10)(x - 14)$  is about 56, at  $x = 12.1$

PTS: 2 REF: 081712aai TOP: Graphing Polynomial Functions

82 ANS:

$$\frac{\sqrt{23}}{5}$$

$$\cos \theta = \pm \sqrt{1 - \left( \frac{-\sqrt{2}}{5} \right)^2} = \pm \sqrt{\frac{25}{25} - \frac{2}{25}} = \pm \frac{\sqrt{23}}{5}$$

PTS: 2 REF: 061712aai TOP: Determining Trigonometric Functions

83 ANS:  
10.4

PTS: 2 REF: 011804aai TOP: Determining Trigonometric Functions  
KEY: radians

84 ANS:  
 $P_0 = 19,378,000$   
 $P_t = 1.015P_{t-1}$

PTS: 2 REF: 081624aai TOP: Sequences

85 ANS:  
0  
Since  $x + 4$  is a factor of  $p(x)$ , there is no remainder.

PTS: 2 REF: 081621aai TOP: Remainder Theorem

86 ANS:  
 $x = \frac{\ln 6}{\ln 2} - 3$   
 $8(2^{x+3}) = 48$   
 $2^{x+3} = 6$

$$(x + 3)\ln 2 = \ln 6$$

$$x + 3 = \frac{\ln 6}{\ln 2}$$

$$x = \frac{\ln 6}{\ln 2} - 3$$

PTS: 2 REF: 061702aai TOP: Exponential Equations  
KEY: without common base

87 ANS:  
2.29 and 3.63

PTS: 2 REF: 011814aai TOP: Other Systems  
KEY: All

88 ANS:

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

$$2d(d^3 + 3d^2 - 9d - 27)$$

$$2d(d^2(d+3) - 9(d+3))$$

$$2d(d^2 - 9)(d+3)$$

$$2d(d+3)(d-3)(d+3)$$

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

PTS: 2 REF: 081615aai TOP: Factoring Polynomials

KEY: factoring by grouping

89 ANS:

II, only

The events are independent because  $P(A \text{ and } B) = P(A) \cdot P(B)$ .

$$0.125 = 0.5 \cdot 0.25$$

If  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.25 + 0.5 - .125 = 0.625$ , then the events are not mutually exclusive because  $P(A \text{ or } B) \neq P(A) + P(B)$

$$0.625 \neq 0.5 + 0.25$$

PTS: 2 REF: 061714aai TOP: Theoretical Probability

90 ANS:

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

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 TOP: Complex Conjugate Root Theorem

91 ANS:

2 or -4

$$x^2 + 2x - 8 = 0$$

$$(x+4)(x-2) = 0$$

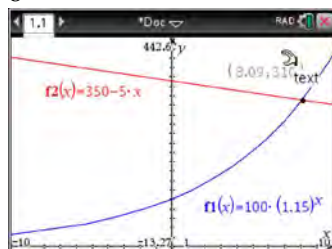
$$x = -4, 2$$

PTS: 2 REF: 081701aai TOP: Undefined Rationals



92 ANS:

8



PTS: 2

REF: 011716aai

TOP: Other Systems

KEY: AII

93 ANS:

 $\{(1,1), (6,16)\}$ 

$$y = g(x) = (x-2)^2 \quad (x-2)^2 = 3x-2 \quad y = 3(6)-2 = 16$$

$$x^2 - 4x + 4 = 3x - 2 \quad y = 3(1) - 2 = 1$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, 1$$

PTS: 2

REF: 011705aai

TOP: Quadratic-Linear Systems

KEY: AII

94 ANS:

 $(1.00427)^m$ 

$$1.0525^{\frac{1}{12}} \approx 1.00427$$

PTS: 2

REF: 061621aai

TOP: Modeling Exponential Functions

KEY: AII

95 ANS:

0.0668



PTS: 2

REF: 081711aai

TOP: Normal Distributions

KEY: percent

96 ANS:

$$9k^2 - 12ki - 4$$

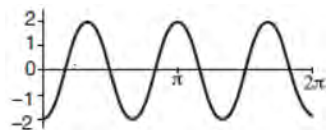
$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

PTS: 2

REF: 081702aii

TOP: Operations with Complex Numbers

97 ANS:

(3) repeats 3 times over  $2\pi$ .

PTS: 2

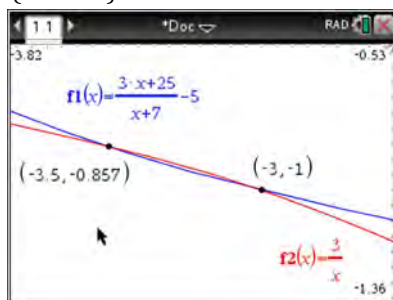
REF: 011722aii

TOP: Graphing Trigonometric Functions

KEY: recognize

98 ANS:

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



$$x(x+7) \left[ \frac{3x+25}{x+7} - 5 = \frac{3}{x} \right]$$

$$x(3x+25) - 5x(x+7) = 3(x+7)$$

$$3x^2 + 25x - 5x^2 - 35x = 3x + 21$$

$$2x^2 + 13x + 21 = 0$$

$$(2x+7)(x+3) = 0$$

$$x = -\frac{7}{2}, -3$$

PTS: 2

REF: fall1501aii

TOP: Solving Rationals

KEY: rational solutions

99 ANS:

$$\frac{\ln\left(\frac{c}{a}\right)}{b}$$

$$e^{bt} = \frac{c}{a}$$

$$\ln e^{bt} = \ln \frac{c}{a}$$

$$bt \ln e = \ln \frac{c}{a}$$

$$t = \frac{\ln \frac{c}{a}}{b}$$

PTS: 2

REF: 011813aai

TOP: Exponential Growth

100 ANS:

10

$$440 \times 2.3\% \approx 10$$

PTS: 2

REF: 011807aai

TOP: Normal Distributions

KEY: predict

101 ANS:

2%

$$9110 = 5000e^{30r}$$

$$\ln \frac{911}{500} = \ln e^{30r}$$

$$\frac{\ln \frac{911}{500}}{30} = r$$

$$r \approx .02$$

PTS: 2

REF: 011810aai

TOP: Exponential Growth

102 ANS:

$$a_0 = 1000$$

$$a_n = a_{n-1}(1.018) + 750$$

PTS: 2

REF: 081724aai

TOP: Sequences