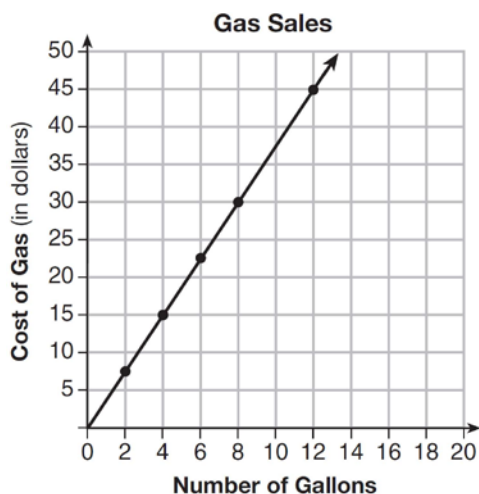


0116AI Common Core State Standards

- 1 In the function $f(x) = (x - 2)^2 + 4$, the minimum value occurs when x is
 - 1) -2
 - 2) 2
 - 3) -4
 - 4) 4

- 2 The graph below was created by an employee at a gas station.



Which statement can be justified by using the graph?

- 1) If 10 gallons of gas was purchased, \$35 was paid.
- 2) For every gallon of gas purchased, \$3.75 was paid.
- 3) For every 2 gallons of gas purchased, \$5.00 was paid.
- 4) If zero gallons of gas were purchased, zero miles were driven.

- 3 For a recently released movie, the function $y = 119.67(0.61)^x$ models the revenue earned, y , in millions of dollars each week, x , for several weeks after its release. Based on the equation, how much more money, in millions of dollars, was earned in revenue for week 3 than for week 5?
 - 1) 37.27
 - 2) 27.16
 - 3) 17.06
 - 4) 10.11

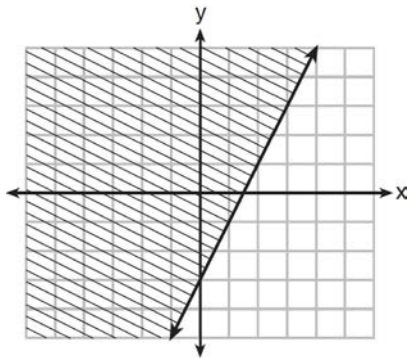
- 4 Given the following expressions:

| | |
|---------------------------------|------------------------------------|
| I. $-\frac{5}{8} + \frac{3}{5}$ | III. $(\sqrt{5}) \cdot (\sqrt{5})$ |
| II. $\frac{1}{2} + \sqrt{2}$ | IV. $3 \cdot (\sqrt{49})$ |

Which expression(s) result in an irrational number?

- 1) II, only
- 2) III, only
- 3) I, III, IV
- 4) II, III, IV

- 5 Which inequality is represented by the graph below?



- 1) $y \leq 2x - 3$
 2) $y \geq 2x - 3$
 3) $y \leq -3x + 2$
 4) $y \geq -3x + 2$
- 6 Michael borrows money from his uncle, who is charging him simple interest using the formula $I = Prt$. To figure out what the interest rate, r , is, Michael rearranges the formula to find r . His new formula is r equals
- 1) $\frac{I - P}{t}$
 2) $\frac{P - I}{t}$
 3) $\frac{I}{Pt}$
 4) $\frac{Pt}{I}$
- 7 Which equation is equivalent to $y - 34 = x(x - 12)$?
- 1) $y = (x - 17)(x + 2)$
 2) $y = (x - 17)(x - 2)$
 3) $y = (x - 6)^2 + 2$
 4) $y = (x - 6)^2 - 2$

- 8 The equation $A = 1300(1.02)^7$ is being used to calculate the amount of money in a savings account. What does 1.02 represent in this equation?
- 1) 0.02% decay
 2) 0.02% growth
 3) 2% decay
 4) 2% growth
- 9 The zeros of the function $f(x) = 2x^2 - 4x - 6$ are
- 1) 3 and -1
 2) 3 and 1
 3) -3 and 1
 4) -3 and -1
- 10 When $(2x - 3)^2$ is subtracted from $5x^2$, the result is
- 1) $x^2 - 12x - 9$
 2) $x^2 - 12x + 9$
 3) $x^2 + 12x - 9$
 4) $x^2 + 12x + 9$
- 11 Joe has a rectangular patio that measures 10 feet by 12 feet. He wants to increase the area by 50% and plans to increase each dimension by equal lengths, x . Which equation could be used to determine x ?
- 1) $(10 + x)(12 + x) = 120$
 2) $(10 + x)(12 + x) = 180$
 3) $(15 + x)(18 + x) = 180$
 4) $(15)(18) = 120 + x^2$
- 12 When factored completely, $x^3 - 13x^2 - 30x$ is
- 1) $x(x + 3)(x - 10)$
 2) $x(x - 3)(x - 10)$
 3) $x(x + 2)(x - 15)$
 4) $x(x - 2)(x + 15)$

- 13 The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

| Year | 1898 | 1971 | 1985 | 2006 | 2012 |
|----------|------|------|------|------|------|
| Cost (c) | 1 | 6 | 14 | 24 | 35 |

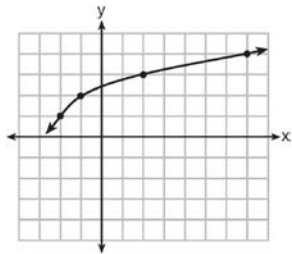
- 1) 1898-1971
 2) 1971-1985
 3) 1985-2006
 4) 2006-2012
- 14 When solving the equation $x^2 - 8x - 7 = 0$ by completing the square, which equation is a step in the process?
- 1) $(x - 4)^2 = 9$
 2) $(x - 4)^2 = 23$
 3) $(x - 8)^2 = 9$
 4) $(x - 8)^2 = 23$
- 15 A construction company uses the function $f(p)$, where p is the number of people working on a project, to model the amount of money it spends to complete a project. A reasonable domain for this function would be
- 1) positive integers
 2) positive real numbers
 3) both positive and negative integers
 4) both positive and negative real numbers

- 16 Which function is shown in the table below?

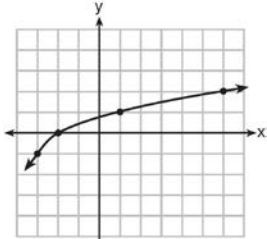
| x | f(x) |
|----|---------------|
| -2 | $\frac{1}{9}$ |
| -1 | $\frac{1}{3}$ |
| 0 | 1 |
| 1 | 3 |
| 2 | 9 |
| 3 | 27 |

- 1) $f(x) = 3x$
 2) $f(x) = x + 3$
 3) $f(x) = -x^3$
 4) $f(x) = 3^x$
- 17 Given the functions $h(x) = \frac{1}{2}x + 3$ and $j(x) = |x|$, which value of x makes $h(x) = j(x)$?
- 1) -2
 2) 2
 3) 3
 4) -6
- 18 Which recursively defined function represents the sequence 3, 7, 15, 31, ...?
- 1) $f(1) = 3, f(n + 1) = 2^{f(n)} + 3$
 2) $f(1) = 3, f(n + 1) = 2^{f(n)} - 1$
 3) $f(1) = 3, f(n + 1) = 2f(n) + 1$
 4) $f(1) = 3, f(n + 1) = 3f(n) - 2$
- 19 The range of the function defined as $y = 5^x$ is
- 1) $y < 0$
 2) $y > 0$
 3) $y \leq 0$
 4) $y \geq 0$

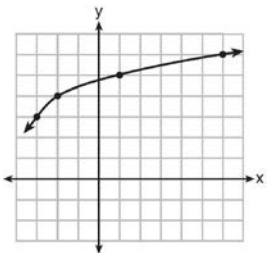
20 The graph of $y = f(x)$ is shown below.



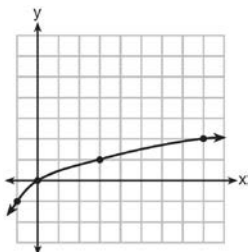
What is the graph of $y = f(x + 1) - 2$?



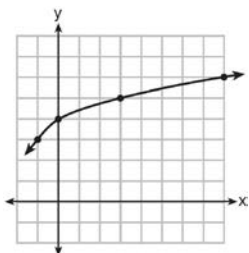
1)



2)



3)



4)

21 Which pair of equations could *not* be used to solve the following equations for x and y ?

$$4x + 2y = 22$$

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

1) $4x + 2y = 22$

$$2x - 2y = 8$$

2) $4x + 2y = 22$

$$-4x + 4y = -16$$

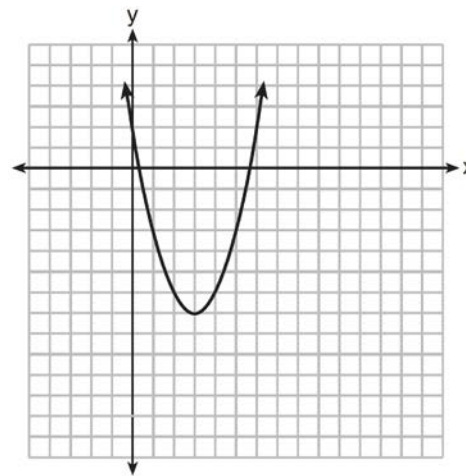
3) $12x + 6y = 66$

$$6x - 6y = 24$$

4) $8x + 4y = 44$

$$-8x + 8y = -8$$

22 The graph representing a function is shown below.



Which function has a minimum that is *less* than the one shown in the graph?

1) $y = x^2 - 6x + 7$

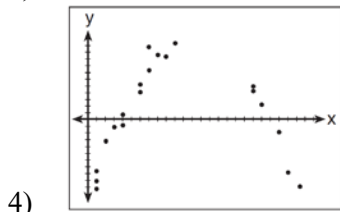
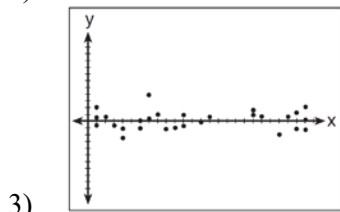
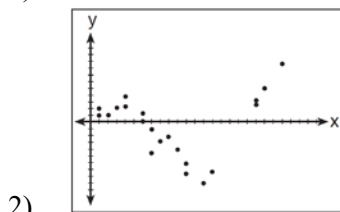
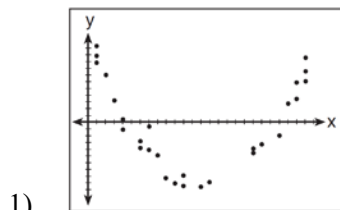
2) $y = |x + 3| - 6$

3) $y = x^2 - 2x - 10$

4) $y = |x - 8| + 2$

- 23 Grisham is considering the three situations below.
- I. For the first 28 days, a sunflower grows at a rate of 3.5 cm per day.
 - II. The value of a car depreciates at a rate of 15% per year after it is purchased.
 - III. The amount of bacteria in a culture triples every two days during an experiment.
- Which of the statements describes a situation with an equal difference over an equal interval?
- 1) I, only
 - 2) II, only
 - 3) I and III
 - 4) II and III

- 24 After performing analyses on a set of data, Jackie examined the scatter plot of the residual values for each analysis. Which scatter plot indicates the best linear fit for the data?

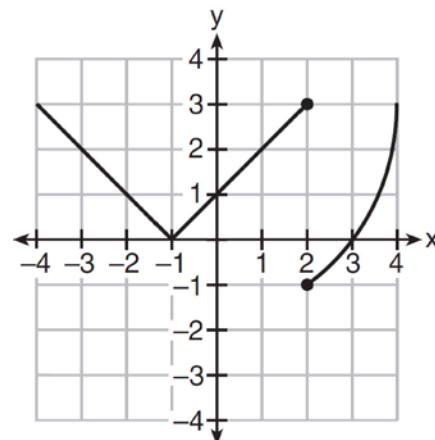


- 25 The function, $t(x)$, is shown in the table below.

| x | $t(x)$ |
|-----|--------|
| -3 | 10 |
| -1 | 7.5 |
| 1 | 5 |
| 3 | 2.5 |
| 5 | 0 |

Determine whether $t(x)$ is linear or exponential. Explain your answer.

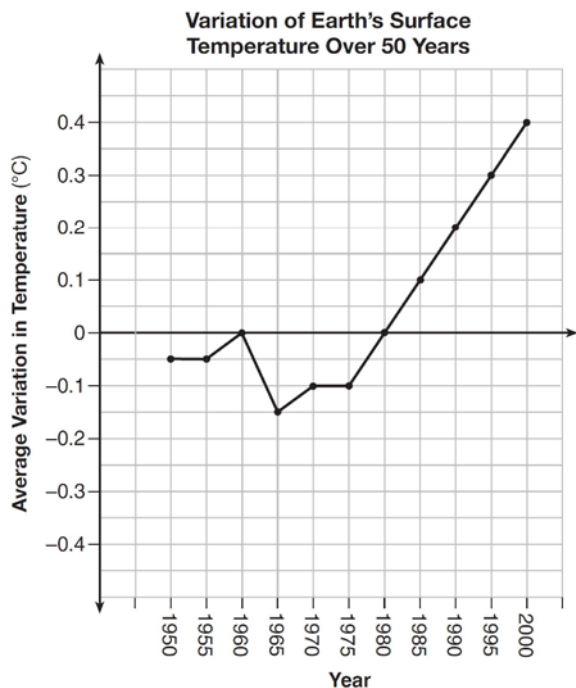
- 26 Marcel claims that the graph below represents a function.



State whether Marcel is correct. Justify your answer.

- 27 Solve the equation for y : $(y - 3)^2 = 4y - 12$

- 28 The graph below shows the variation in the average temperature of Earth's surface from 1950-2000, according to one source.



During which years did the temperature variation change the most per unit time? Explain how you determined your answer.

- 29 The cost of belonging to a gym can be modeled by $C(m) = 50m + 79.50$, where $C(m)$ is the total cost for m months of membership. State the meaning of the slope and y -intercept of this function with respect to the costs associated with the gym membership.

- 30 A statistics class surveyed some students during one lunch period to obtain opinions about television programming preferences. The results of the survey are summarized in the table below.

Programming Preferences

| | Comedy | Drama |
|--------|--------|-------|
| Male | 70 | 35 |
| Female | 48 | 42 |

Based on the sample, predict how many of the school's 351 males would prefer comedy. Justify your answer.

- 31 Given that $a > b$, solve for x in terms of a and b :

$$b(x - 3) \geq ax + 7b$$

- 32 Jacob and Jessica are studying the spread of dandelions. Jacob discovers that the growth over t weeks can be defined by the function $f(t) = (8) \cdot 2^t$. Jessica finds that the growth function over t weeks is $g(t) = 2^{t+3}$. Calculate the number of dandelions that Jacob and Jessica will each have after 5 weeks. Based on the growth from both functions, explain the relationship between $f(t)$ and $g(t)$.

- 33 Let $h(t) = -16t^2 + 64t + 80$ represent the height of an object above the ground after t seconds. Determine the number of seconds it takes to achieve its maximum height. Justify your answer. State the time interval, in seconds, during which the height of the object *decreases*. Explain your reasoning.

- 34 Fred's teacher gave the class the quadratic function

$$f(x) = 4x^2 + 16x + 9.$$

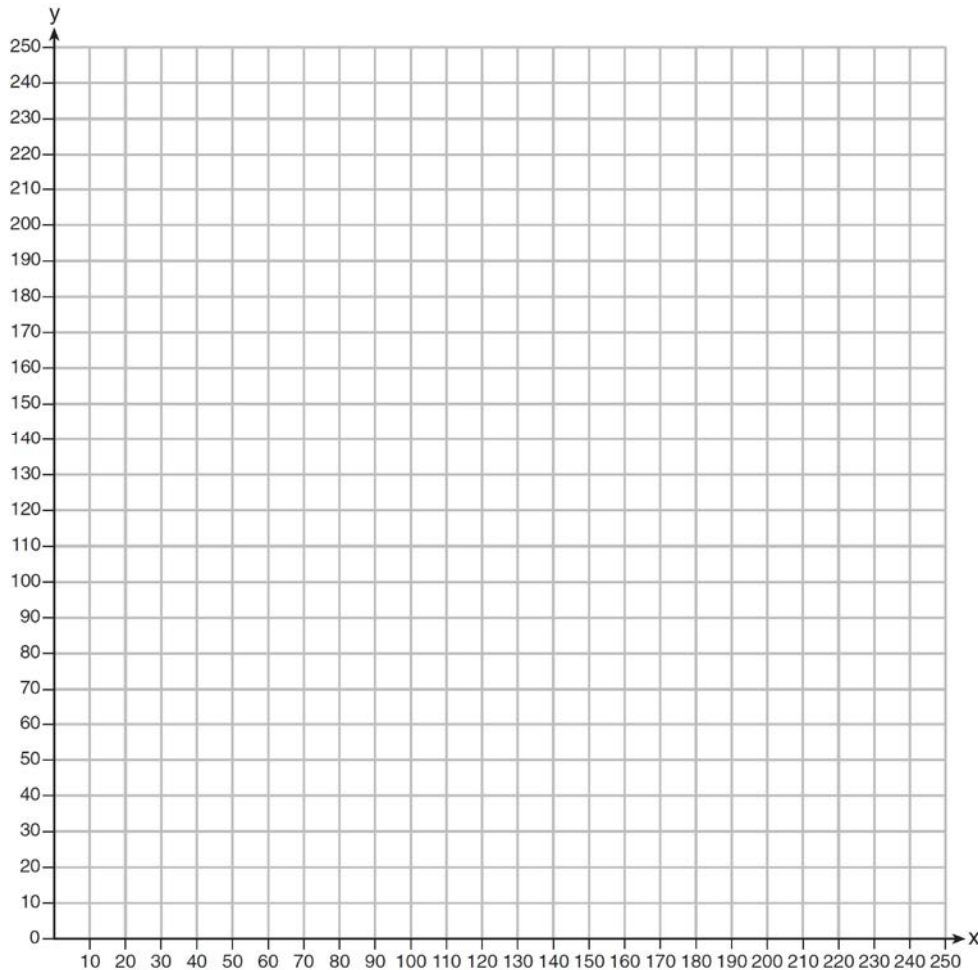
- a) State two different methods Fred could use to solve the equation $f(x) = 0$.
- b) Using one of the methods stated in part *a*, solve $f(x) = 0$ for x , to the *nearest tenth*.
- 35 Erica, the manager at Stellarbeans, collected data on the daily high temperature and revenue from coffee sales. Data from nine days this past fall are shown in the table below.

| | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| High Temperature, t | 54 | 50 | 62 | 67 | 70 | 58 | 52 | 46 | 48 |
| Coffee Sales, $f(t)$ | \$2900 | \$3080 | \$2500 | \$2380 | \$2200 | \$2700 | \$3000 | \$3620 | \$3720 |

State the linear regression function, $f(t)$, that estimates the day's coffee sales with a high temperature of t . Round all values to the *nearest integer*. State the correlation coefficient, r , of the data to the *nearest hundredth*. Does r indicate a strong linear relationship between the variables? Explain your reasoning.

- 36 A contractor has 48 meters of fencing that he is going to use as the perimeter of a rectangular garden. The length of one side of the garden is represented by x , and the area of the garden is 108 square meters. Determine, algebraically, the dimensions of the garden in meters.

- 37 The Reel Good Cinema is conducting a mathematical study. In its theater, there are 200 seats. Adult tickets cost \$12.50 and child tickets cost \$6.25. The cinema's goal is to sell at least \$1500 worth of tickets for the theater. Write a system of linear inequalities that can be used to find the possible combinations of adult tickets, x , and child tickets, y , that would satisfy the cinema's goal. Graph the solution to this system of inequalities on the set of axes below. Label the solution with an S . Marta claims that selling 30 adult tickets and 80 child tickets will result in meeting the cinema's goal. Explain whether she is correct or incorrect, based on the graph drawn.



**0116AI Common Core State Standards
Answer Section**

- 1 ANS: 2 PTS: 2 REF: 011601ai NAT: A.SSE.B.3
TOP: Vertex Form of a Quadratic
- 2 ANS: 2 PTS: 2 REF: 011602ai NAT: A.CED.A.2
TOP: Graphing Linear Functions
- 3 ANS: 3
 $119.67(0.61)^5 - 119.67(0.61)^3 \approx 17.06$
- PTS: 2 REF: 011603ai NAT: F.IF.A.2 TOP: Evaluating Functions
- 4 ANS: 1 PTS: 2 REF: 011604ai NAT: N.RN.B.3
TOP: Classifying Numbers
- 5 ANS: 2 PTS: 2 REF: 011605ai NAT: A.REI.D.12
TOP: Graphing Linear Inequalities
- 6 ANS: 3 PTS: 2 REF: 011606ai NAT: A.CED.A.4
TOP: Transforming Formulas
- 7 ANS: 4
 $y - 34 = x^2 - 12x$
 $y = x^2 - 12x + 34$
 $y = x^2 - 12x + 36 - 2$
 $y = (x - 6)^2 - 2$
- PTS: 2 REF: 011607ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square
- 8 ANS: 4 PTS: 2 REF: 011608ai NAT: F.LE.B.5
TOP: Modeling Exponential Functions
- 9 ANS: 1
 $2x^2 - 4x - 6 = 0$
 $2(x^2 - 2x - 3) = 0$
 $2(x - 3)(x + 1) = 0$
 $x = 3, -1$
- PTS: 2 REF: 011609ai NAT: A.SSE.B.3 TOP: Solving Quadratics
- 10 ANS: 3
 $5x^2 - (4x^2 - 12x + 9) = x^2 + 12x - 9$
- PTS: 2 REF: 011610ai NAT: A.APR.A.1 TOP: Operations with Polynomials
KEY: multiplication
- 11 ANS: 2 PTS: 2 REF: 011611ai NAT: A.CED.A.1
TOP: Geometric Applications of Quadratics
- 12 ANS: 3 PTS: 2 REF: 011612ai NAT: A.SSE.A.2
TOP: Factoring Polynomials KEY: higher power

13 ANS: 4
 (1) $\frac{6-1}{1971-1898} = \frac{5}{73} \approx .07$ (2) $\frac{14-6}{1985-1971} = \frac{8}{14} \approx .57$ (3) $\frac{24-14}{2006-1985} = \frac{10}{21} \approx .48$ (4) $\frac{35-24}{2012-2006} = \frac{11}{6} \approx 1.83$

PTS: 2 REF: 011613ai NAT: F.IF.B.6 TOP: Rate of Change

14 ANS: 2
 $x^2 - 8x = 7$
 $x^2 - 8x + 16 = 7 + 16$
 $(x - 4)^2 = 23$

PTS: 2 REF: 011614ai NAT: A.REI.B.4 TOP: Solving Quadratics
 KEY: completing the square

15 ANS: 1 PTS: 2 REF: 011615ai NAT: F.IF.B.5
 TOP: Domain and Range

16 ANS: 4 PTS: 2 REF: 011616ai NAT: F.LE.A.2
 TOP: Families of Functions

17 ANS: 1
 $\frac{1}{2}x + 3 = |x| \quad -\frac{1}{2}x - 3 = x$
 $\frac{1}{2}x + 3 = x \quad -x - 6 = 2x$
 $x + 6 = 2x \quad -6 = 3x$
 $6 = x \quad -2 = x$

PTS: 2 REF: 011617ai NAT: A.REI.D.11 TOP: Other Systems
 KEY: AI

18 ANS: 3 PTS: 2 REF: 011618ai NAT: F.LE.A.2
 TOP: Sequences

19 ANS: 2 PTS: 2 REF: 011619ai NAT: F.IF.A.2
 TOP: Domain and Range
 KEY: real domain, exponential

20 ANS: 1 PTS: 2 REF: 011620ai NAT: F.BF.B.3
 TOP: Transformations with Functions
 KEY: bimodalgraph

21 ANS: 4 PTS: 2 REF: 011621ai NAT: A.REI.C.5
 TOP: Solving Linear Systems

22 ANS: 3 PTS: 2 REF: 011622ai NAT: F.IF.C.9
 TOP: Comparing Functions

23 ANS: 1 PTS: 2 REF: 011623ai NAT: F.LE.A.1
 TOP: Families of Functions

24 ANS: 3
 For a residual plot, there should be no observable pattern and a similar distribution of residuals above and below the x -axis.

PTS: 2 REF: 011624ai NAT: S.ID.B.6 TOP: Correlation Coefficient and Residuals

- 25 ANS:
Linear, because the function has a constant rate of change.
- PTS: 2 REF: 011625ai NAT: F.LE.A.1 TOP: Families of Functions
- 26 ANS:
No, because the relation does not pass the vertical line test.
- PTS: 2 REF: 011626ai NAT: F.IF.A.1 TOP: Defining Functions
KEY: graphs
- 27 ANS:

$$y^2 - 6y + 9 = 4y - 12$$

$$y^2 - 10y + 21 = 0$$

$$(y - 7)(y - 3) = 0$$

$$y = 7, 3$$
- PTS: 2 REF: 011627ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: factoring
- 28 ANS:
During 1960-1965 the graph has the steepest slope.
- PTS: 2 REF: 011628ai NAT: F.IF.B.6 TOP: Rate of Change
- 29 ANS:
The slope represents the amount paid each month and the y -intercept represents the initial cost of membership.
- PTS: 2 REF: 011629ai NAT: F.LE.B.5 TOP: Modeling Linear Functions
- 30 ANS:

$$\frac{m}{351} = \frac{70}{70 + 35}$$

$$105m = 24570$$

$$m = 234$$
- PTS: 2 REF: 011630ai NAT: S.ID.B.5 TOP: Frequency Tables
- 31 ANS:

$$b(x - 3) \geq ax + 7b$$

$$bx - 3b \geq ax + 7b$$

$$bx - ax \geq 10b$$

$$x(b - a) \geq 10b$$

$$x \leq \frac{10b}{b - a}$$
- PTS: 2 REF: 011631ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

32 ANS:

$$f(5) = (8) \cdot 2^5 = 256 \quad f(t) = g(t)$$

$$g(5) = 2^{5+3} = 256 \quad (8) \cdot 2^t = 2^{t+3}$$

$$2^3 \cdot 2^t = 2^{t+3}$$

$$2^{t+3} = 2^{t+3}$$

PTS: 2 REF: 011632ai NAT: A.SSE.B.3 TOP: Exponential Equations

33 ANS:

$$t = \frac{-b}{2a} = \frac{-64}{2(-16)} = \frac{-64}{-32} = 2 \text{ seconds. The height decreases after reaching its maximum at } t = 2 \text{ until it lands at}$$

$$t = 5 - 16t^2 + 64t + 80 = 0$$

$$t^2 - 4t - 5 = 0$$

$$(t - 5)(t + 1) = 0$$

$$t = 5$$

PTS: 4 REF: 011633ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions

34 ANS:

Two of the following: quadratic formula, complete the square, factor by grouping or graphically.

$$x = \frac{-16 \pm \sqrt{16^2 - 4(4)(9)}}{2(4)} = \frac{-16 \pm \sqrt{112}}{8} \approx -0.7, -3.3$$

PTS: 4 REF: 011634ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: quadratic formula

35 ANS:

 $f(t) = -58t + 6182 \quad r = -.94$ This indicates a strong linear relationship because r is close to -1.

PTS: 4 REF: 011635ai NAT: S.ID.B.6 TOP: Regression

KEY: linear

36 ANS:

$$108 = x(24 - x) \quad 18 \times 6$$

$$108 = 24x - x^2$$

$$x^2 - 24x + 108 = 0$$

$$(x - 18)(x - 6) = 0$$

$$x = 18, 6$$

PTS: 4 REF: 011636ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

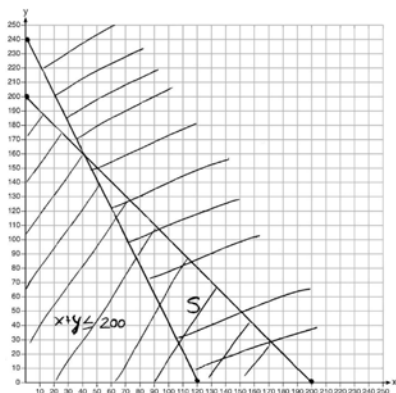
37 ANS:

$x + y \leq 200$ Marta is incorrect because $12.5(30) + 6.25(80) < 1500$

$12.5x + 6.25y \geq 1500$

$375 + 500 < 1500$

$875 < 1500$



PTS: 6

REF: 011637ai

NAT: A.REI.D.12

TOP: Graphing Systems of Linear Inequalities

KEY: graph