

**0117AI**

- 1 Which expression is equivalent to  $16x^2 - 36$ ?
- 1)  $4(2x - 3)(2x - 3)$                       3)  $(4x - 6)(4x - 6)$   
 2)  $4(2x + 3)(2x - 3)$                       4)  $(4x + 6)(4x + 6)$
- 2 What is the solution set of the equation  $(x - 2)(x - a) = 0$ ?
- 1)  $-2$  and  $a$                                   3)  $2$  and  $a$   
 2)  $-2$  and  $-a$                                 4)  $2$  and  $-a$
- 3 Analysis of data from a statistical study shows a linear relationship in the data with a correlation coefficient of  $-0.524$ . Which statement best summarizes this result?
- 1) There is a strong positive correlation between the variables.                      3) There is a moderate positive correlation between the variables.  
 2) There is a strong negative correlation between the variables.                      4) There is a moderate negative correlation between the variables.
- 4 Boyle's Law involves the pressure and volume of gas in a container. It can be represented by the formula  $P_1 V_1 = P_2 V_2$ . When the formula is solved for  $P_2$ , the result is
- 1)  $P_1 V_1 V_2$                                       3)  $\frac{P_1 V_1}{V_2}$   
 2)  $\frac{V_2}{P_1 V_1}$                                       4)  $\frac{P_1 V_2}{V_1}$
- 5 A radio station did a survey to determine what kind of music to play by taking a sample of middle school, high school, and college students. They were asked which of three different types of music they prefer on the radio: hip-hop, alternative, or classic rock. The results are summarized in the table below.

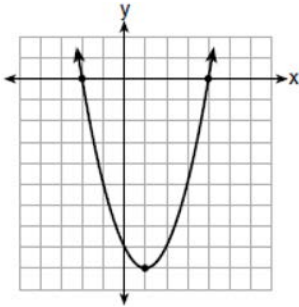
	<b>Hip-Hop</b>	<b>Alternative</b>	<b>Classic Rock</b>
<b>Middle School</b>	28	18	4
<b>High School</b>	22	22	6
<b>College</b>	16	20	14

What percentage of college students prefer classic rock?

- 1) 14%    3) 33%  
 2) 28%    4) 58%

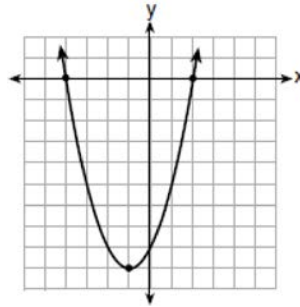
6 Which function has zeros of -4 and 2?

1)  $f(x) = x^2 + 7x - 8$



2)

3)  $g(x) = x^2 - 7x - 8$



4)

7 Which expression is equivalent to  $2(3g - 4) - (8g + 3)$ ?

1)  $-2g - 1$

3)  $-2g - 7$

2)  $-2g - 5$

4)  $-2g - 11$

8 In 2014, the cost to mail a letter was 49¢ for up to one ounce. Every additional ounce cost 21¢. Which recursive function could be used to determine the cost of a 3-ounce letter, in cents?

1)  $a_1 = 49; a_n = a_{n-1} + 21$

3)  $a_1 = 21; a_n = a_{n-1} + 49$

2)  $a_1 = 0; a_n = 49a_{n-1} + 21$

4)  $a_1 = 0; a_n = 21a_{n-1} + 49$

9 A car leaves Albany, NY, and travels west toward Buffalo, NY. The equation  $D = 280 - 59t$  can be used to represent the distance,  $D$ , from Buffalo after  $t$  hours. In this equation, the 59 represents the

1) car's distance from Albany

3) distance between Buffalo and Albany

2) speed of the car

4) number of hours driving

10 Faith wants to use the formula  $C(f) = \frac{5}{9}(f - 32)$  to convert degrees Fahrenheit,  $f$ , to degrees Celsius,  $C(f)$ . If Faith calculated  $C(68)$ , what would her result be?

1) 20° Celsius

3) 154° Celsius

2) 20° Fahrenheit

4) 154° Fahrenheit

11 Which scenario represents exponential growth?

1) A water tank is filled at a rate of 2 gallons/minute.

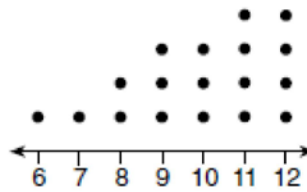
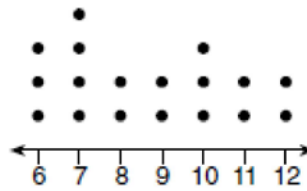
3) A species of fly doubles its population every month during the summer.

2) A vine grows 6 inches every week.

4) A car increases its distance from a garage as it travels at a constant speed of 25 miles per hour.

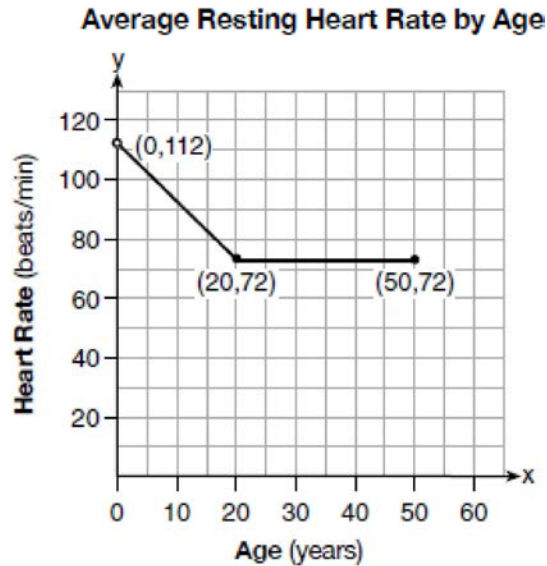
- 12 What is the *minimum* value of the function  $y = |x + 3| - 2$ ?
- |       |       |
|-------|-------|
| 1) -2 | 3) 3  |
| 2) 2  | 4) -3 |
- 13 What type of relationship exists between the number of pages printed on a printer and the amount of ink used by that printer?
- 1) positive correlation, but not causal
  - 2) positive correlation, and causal
  - 3) negative correlation, but not causal
  - 4) negative correlation, and causal
- 14 A computer application generates a sequence of musical notes using the function  $f(n) = 6(16)^n$ , where  $n$  is the number of the note in the sequence and  $f(n)$  is the note frequency in hertz. Which function will generate the same note sequence as  $f(n)$ ?
- |                        |                        |
|------------------------|------------------------|
| 1) $g(n) = 12(2)^{4n}$ | 3) $p(n) = 12(4)^{2n}$ |
| 2) $h(n) = 6(2)^{4n}$  | 4) $k(n) = 6(8)^{2n}$  |
- 15 Which value of  $x$  is a solution to the equation  $13 - 36x^2 = -12$ ?
- |                    |                   |
|--------------------|-------------------|
| 1) $\frac{36}{25}$ | 3) $-\frac{6}{5}$ |
| 2) $\frac{25}{36}$ | 4) $-\frac{5}{6}$ |
- 16 Which point is a solution to the system below?
- $$2y < -12x + 4$$
- $$y < -6x + 4$$
- |                                  |                                   |
|----------------------------------|-----------------------------------|
| 1) $\left(1, \frac{1}{2}\right)$ | 3) $\left(-\frac{1}{2}, 5\right)$ |
| 2) $(0, 6)$                      | 4) $(-3, 2)$                      |
- 17 When the function  $f(x) = x^2$  is multiplied by the value  $a$ , where  $a > 1$ , the graph of the new function,  $g(x) = ax^2$
- 1) opens upward and is wider
  - 2) opens upward and is narrower
  - 3) opens downward and is wider
  - 4) opens downward and is narrower

- 18 Andy has \$310 in his account. Each week,  $w$ , he withdraws \$30 for his expenses. Which expression could be used if he wanted to find out how much money he had left after 8 weeks?
- 1)  $310 - 8w$
  - 2)  $280 + 30(w - 1)$
  - 3)  $310w - 30$
  - 4)  $280 - 30(w - 1)$
- 19 The daily cost of production in a factory is calculated using  $c(x) = 200 + 16x$ , where  $x$  is the number of complete products manufactured. Which set of numbers best defines the domain of  $c(x)$ ?
- 1) integers
  - 2) positive real numbers
  - 3) positive rational numbers
  - 4) whole numbers
- 20 Noah conducted a survey on sports participation. He created the following two dot plots to represent the number of students participating, by age, in soccer and basketball.



- Which statement about the given data sets is correct?
- 1) The data for soccer players are skewed right.
  - 2) The data for soccer players have less spread than the data for basketball players.
  - 3) The data for basketball players have the same median as the data for soccer players.
  - 4) The data for basketball players have a greater mean than the data for soccer players.

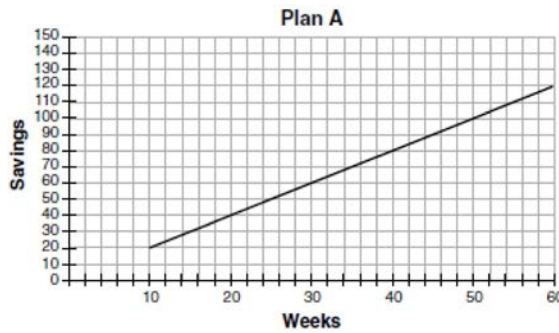
- 21 A graph of average resting heart rates is shown below. The average resting heart rate for adults is 72 beats per minute, but doctors consider resting rates from 60-100 beats per minute within normal range.



Which statement about average resting heart rates is *not* supported by the graph?

- |  |  |
|--|--|
| 1) A 10-year-old has the same average resting heart rate as a 20-year-old. | 3) A 40-year-old may have the same average resting heart rate for ten years. |
| 2) A 20-year-old has the same average resting heart rate as a 30-year-old. | 4) The average resting heart rate for teenagers steadily decreases.          |
- 22 The method of completing the square was used to solve the equation  $2x^2 - 12x + 6 = 0$ . Which equation is a correct step when using this method?
- |                     |                     |
|---------------------|---------------------|
| 1) $(x - 3)^2 = 6$  | 3) $(x - 3)^2 = 3$  |
| 2) $(x - 3)^2 = -6$ | 4) $(x - 3)^2 = -3$ |

- 23 Nancy works for a company that offers two types of savings plans. Plan  $A$  is represented on the graph below.



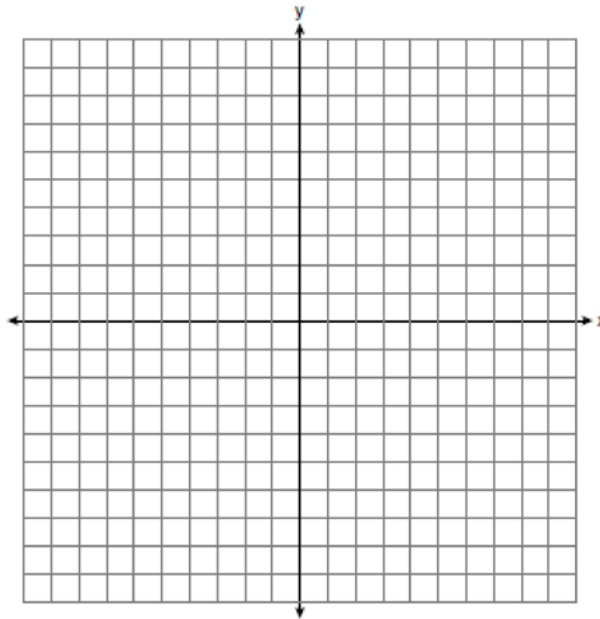
Plan  $B$  is represented by the function  $f(x) = 0.01 + 0.05x^2$ , where  $x$  is the number of weeks. Nancy wants to have the highest savings possible after a year. Nancy picks Plan  $B$ . Her decision is

- 1) correct, because Plan  $B$  is an exponential function and will increase at a faster rate      3) incorrect, because Plan  $A$  will have a higher value after 1 year
- 2) correct, because Plan  $B$  is a quadratic function and will increase at a faster rate      4) incorrect, because Plan  $B$  is a quadratic function and will increase at a slower rate
- 24 The 2014 winner of the Boston Marathon runs as many as 120 miles per week. During the last few weeks of his training for an event, his mileage can be modeled by  $M(w) = 120(.90)^{w-1}$ , where  $w$  represents the number of weeks since training began. Which statement is true about the model  $M(w)$ ?
- 1) The number of miles he runs will increase by 90% each week.      3)  $M(w)$  represents the total mileage run in a given week.
- 2) The number of miles he runs will be 10% of the previous week.      4)  $w$  represents the number of weeks left until his marathon.
- 25 In attempting to solve the system of equations  $y = 3x - 2$  and  $6x - 2y = 4$ , John graphed the two equations on his graphing calculator. Because he saw only one line, John wrote that the answer to the system is the empty set. Is he correct? Explain your answer.
- 26 A typical marathon is 26.2 miles. Allan averages 12 kilometers per hour when running in marathons. Determine how long it would take Allan to complete a marathon, to the *nearest tenth of an hour*. Justify your answer.

- 27 Solve the inequality below:

$$1.8 - 0.4y \geq 2.2 - 2y$$

- 28 Jakob is working on his math homework. He decides that the sum of the expression  $\frac{1}{3} + \frac{6\sqrt{5}}{7}$  must be rational because it is a fraction. Is Jakob correct? Explain your reasoning.
- 29 Graph the inequality  $y > 2x - 5$  on the set of axes below. State the coordinates of a point in its solution.

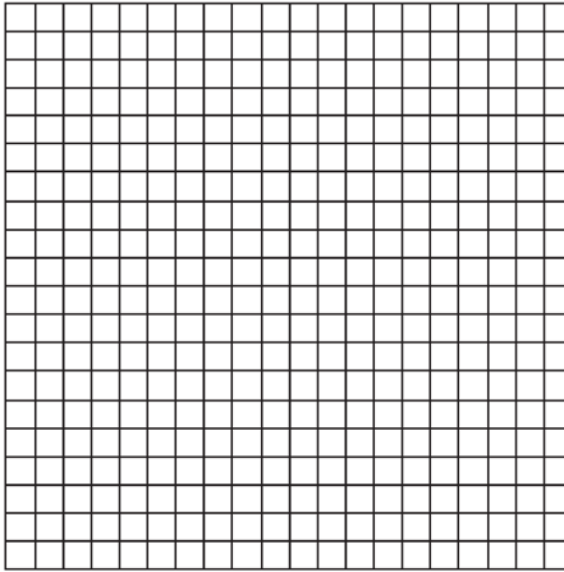


- 30 Sandy programmed a website's checkout process with an equation to calculate the amount customers will be charged when they download songs. The website offers a discount. If one song is bought at the full price of \$1.29, then each additional song is \$.99. State an equation that represents the cost,  $C$ , when  $s$  songs are downloaded. Sandy figured she would be charged \$52.77 for 52 songs. Is this the correct amount? Justify your answer.
- 31 A family is traveling from their home to a vacation resort hotel. The table below shows their distance from home as a function of time.

<b>Time (hrs)</b>	0	2	5	7
<b>Distance (mi)</b>	0	140	375	480

Determine the average rate of change between hour 2 and hour 7, including units.

- 32 Nora says that the graph of a circle is a function because she can trace the whole graph without picking up her pencil. Mia says that a circle graph is *not* a function because multiple values of  $x$  map to the same  $y$ -value. Determine if either one is correct, and justify your answer completely.
- 33 Graph  $f(x) = |x|$  and  $g(x) = -x^2 + 6$  on the grid below. Does  $f(-2) = g(-2)$ ? Use your graph to explain why or why not.



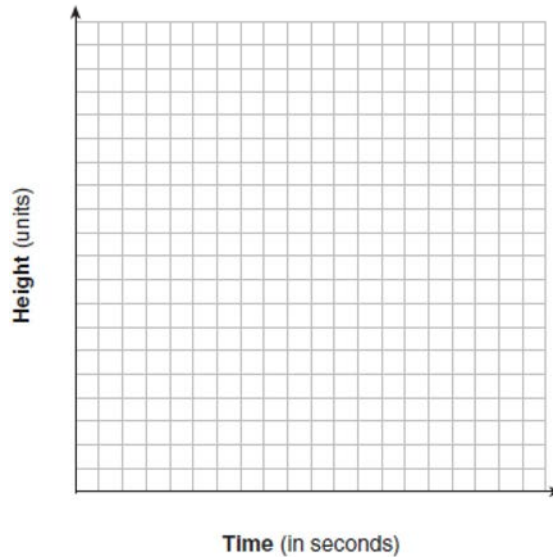
- 34 Two friends went to a restaurant and ordered one plain pizza and two sodas. Their bill totaled \$15.95. Later that day, five friends went to the same restaurant. They ordered three plain pizzas and each person had one soda. Their bill totaled \$45.90. Write and solve a system of equations to determine the price of one plain pizza. [Only an algebraic solution can receive full credit.]
- 35 Tanya is making homemade greeting cards. The data table below represents the amount she spends in dollars,  $f(x)$ , in terms of the number of cards she makes,  $x$ .

$x$	$f(x)$
4	7.50
6	9
9	11.25
10	12

Write a linear function,  $f(x)$ , that represents the data. Explain what the slope and  $y$ -intercept of  $f(x)$  mean in the given context.



- 36 Alex launched a ball into the air. The height of the ball can be represented by the equation  $h = -8t^2 + 40t + 5$ , where  $h$  is the height, in units, and  $t$  is the time, in seconds, after the ball was launched. Graph the equation from  $t = 0$  to  $t = 5$  seconds.



State the coordinates of the vertex and explain its meaning in the context of the problem.

- 37 Ian is borrowing \$1000 from his parents to buy a notebook computer. He plans to pay them back at the rate of \$60 per month. Ken is borrowing \$600 from his parents to purchase a snowboard. He plans to pay his parents back at the rate of \$20 per month. Write an equation that can be used to determine after how many months the boys will owe the same amount. Determine algebraically and state in how many months the two boys will owe the same amount. State the amount they will owe at this time. Ian claims that he will have his loan paid off 6 months after he and Ken owe the same amount. Determine and state if Ian is correct. Explain your reasoning.

## 0117AI

## Answer Section

1 ANS: 2

$$16x^2 - 36 = 4(2x + 3)(2x - 3)$$

PTS: 2 REF: 011701ai NAT: A.SSE.A.2

TOP: Factoring the Difference of Perfect Squares

KEY: quadratic

2 ANS: 3

PTS: 2

REF: 011702ai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: factoring

3 ANS: 4

PTS: 2

REF: 011703ai

NAT: S.ID.C.8

TOP: Correlation Coefficient

4 ANS: 3

PTS: 2

REF: 011704ai

NAT: A.CED.A.4

TOP: Transforming Formulas

5 ANS: 2

$$\frac{14}{16 + 20 + 14} = 28\%$$

PTS: 2

REF: 011705ai

NAT: S.ID.B.5

TOP: Frequency Tables

KEY: two-way

6 ANS: 4

PTS: 2

REF: 011706ai

NAT: A.APR.B.3

TOP: Zeros of Polynomials

7 ANS: 4

$$2(3g - 4) - (8g + 3) = 6g - 8 - 8g - 3 = -2g - 11$$

PTS: 2

REF: 011707ai

NAT: A.APR.A.1

TOP: Operations with Polynomials

KEY: subtraction

8 ANS: 1

PTS: 2

REF: 011708ai

NAT: F.LE.A.2

TOP: Sequences

KEY: recursive

9 ANS: 2

PTS: 2

REF: 011709ai

NAT: F.LE.B.5

TOP: Modeling Linear Functions

10 ANS: 1

$$C(68) = \frac{5}{9}(68 - 32) = 20$$

PTS: 2

REF: 011710ai

NAT: N.Q.A.1

TOP: Conversions

KEY: formula

11 ANS: 3

PTS: 2

REF: 011711ai

NAT: F.LE.A.1

TOP: Families of Functions

12 ANS: 1

PTS: 2

REF: 011712ai

NAT: F.IF.C.7

TOP: Graphing Absolute Value Functions

13 ANS: 2

PTS: 2

REF: 011713ai

NAT: S.ID.C.9

TOP: Analysis of Data

14 ANS: 2

PTS: 2

REF: 011714ai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

15 ANS: 4

$$36x^2 = 25$$

$$x^2 = \frac{25}{36}$$

$$x = \pm \frac{5}{6}$$

PTS: 2 REF: 011715ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: taking square roots

16 ANS: 4

$$2(2) < -12(-3) + 4 \quad 4 < -6(-3) + 4$$

$$4 < 40 \quad 4 < 22$$

PTS: 2 REF: 011716ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities

KEY: solution set

17 ANS: 2

PTS: 2

REF: 011717ai

NAT: F.BF.B.3

TOP: Graphing Polynomial Functions

18 ANS: 4

PTS: 2

REF: 011718ai

NAT: A.SSE.A.1

TOP: Modeling Expressions

19 ANS: 4

PTS: 2

REF: 011719ai

NAT: F.IF.B.5

TOP: Domain and Range

20 ANS: 4

PTS: 2

REF: 011720ai

NAT: S.ID.A.2

TOP: Central Tendency and Dispersion

21 ANS: 1

PTS: 2

REF: 011721ai

NAT: F.IF.B.6

TOP: Rate of Change

22 ANS: 1

$$2(x^2 - 6x + 3) = 0$$

$$x^2 - 6x = -3$$

$$x^2 - 6x + 9 = -3 + 9$$

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

PTS: 2 REF: 011722ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: completing the square

23 ANS: 2

PTS: 2

REF: 011723ai

NAT: F.IF.C.9

TOP: Comparing Functions

24 ANS: 3

PTS: 2

REF: 011724ai

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

25 ANS:

No. There are infinite solutions.

PTS: 2 REF: 011725ai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: substitution

26 ANS:

$$12 \text{ km} \left( \frac{0.62 \text{ m}}{1 \text{ km}} \right) = 7.44 \text{ m} \frac{26.2 \text{ m}}{7.44 \text{ mph}} \approx 3.5 \text{ hours}$$

PTS: 2 REF: 011726ai NAT: N.Q.A.1 TOP: Conversions  
KEY: dimensional analysis

27 ANS:

$$1.8 - 0.4y \geq 2.2 - 2y$$

$$1.6y \geq 0.4$$

$$y \geq 0.25$$

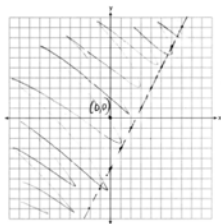
PTS: 2 REF: 011727ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

28 ANS:

No. The sum of a rational and irrational is irrational.

PTS: 2 REF: 011728ai NAT: N.RN.B.3 TOP: Operations with Radicals  
KEY: classify

29 ANS:



PTS: 2 REF: 011729ai NAT: A.REI.D.12 TOP: Graphing Linear Inequalities

30 ANS:

$$C = 1.29 + .99(s - 1) \text{ No, because } C = 1.29 + .99(52 - 1) = 51.78$$

PTS: 2 REF: 011730ai NAT: A.CED.A.2 TOP: Modeling Linear Equations

31 ANS:

$$\frac{480 - 140}{7 - 2} = 68 \text{ mph}$$

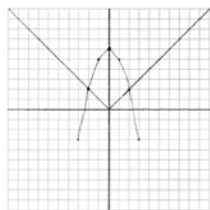
PTS: 2 REF: 011731ai NAT: F.IF.B.6 TOP: Rate of Change

32 ANS:

Neither is correct. Nora's reason is wrong since a circle is not a function because it fails the vertical line test. Mia is wrong since a circle is not a function because multiple values of  $y$  map to the same  $x$ -value.

PTS: 2 REF: 011732ai NAT: F.IF.A.1 TOP: Defining Functions  
KEY: graphs

33 ANS:



Yes, because the graph of  $f(x)$  intersects the graph of  $g(x)$  at  $x = -2$ .

PTS: 4 REF: 011733ai NAT: A.REI.D.11 TOP: Other Systems

34 ANS:

$$p + 2s = 15.95 \quad 5p + 10s = 79.75$$

$$3p + 5s = 45.90 \quad 6p + 10s = 91.80$$

$$p = 12.05$$

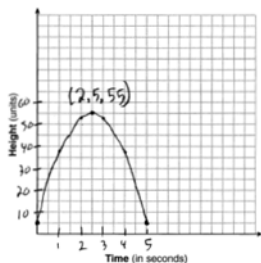
PTS: 4 REF: 011734ai NAT: A.CED.A.3 TOP: Modeling Linear Systems

35 ANS:

$f(x) = 0.75x + 4.50$ . Each card costs 75¢ and start-up costs were \$4.50.

PTS: 4 REF: 011735ai NAT: F.LE.A.2 TOP: Modeling Linear Functions

36 ANS:



The ball reaches a maximum height of 55 units at 2.5 seconds.

PTS: 4 REF: 011736ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions

KEY: context

37 ANS:

$$1000 - 60x = 600 - 20x. \quad 1000 - 60(10) = 400. \quad \text{Ian is incorrect because } I = 1000 - 6(16) = 40 \neq 0$$

$$40x = 400$$

$$x = 10$$

PTS: 6 REF: 011737ai NAT: A.CED.A.1 TOP: Modeling Linear Equations