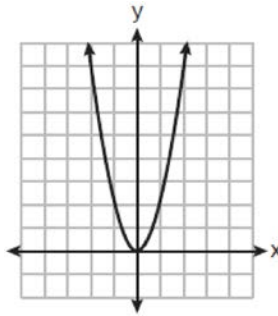
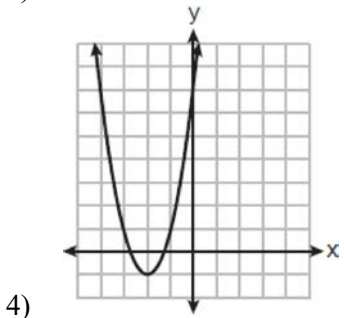
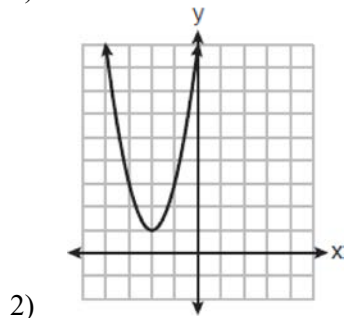
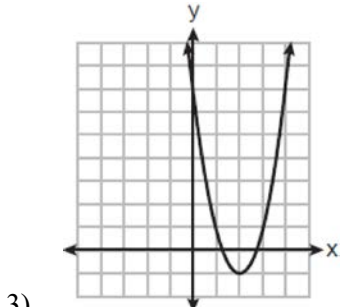
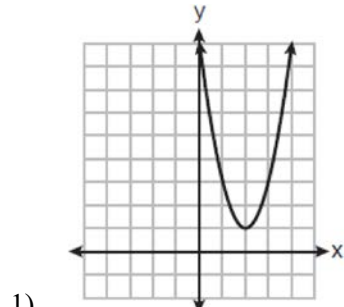




5 The graph of  $y = f(x)$  is shown below.



Which graph represents  $y = f(x - 2) + 1$ ?



6 The length of a rectangular flat-screen television is six inches less than twice its width,  $x$ . If the area of the television screen is 1100 square inches, which equation can be used to determine the width, in inches?

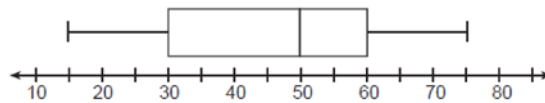
1)  $x(2x - 6) = 1100$

3)  $2x + 2(2x - 6) = 1100$

2)  $x(6 - 2x) = 1100$

4)  $2x + 2(6 - 2x) = 1100$

7 A box plot is shown below.



Which number represents the third quartile?

1) 30

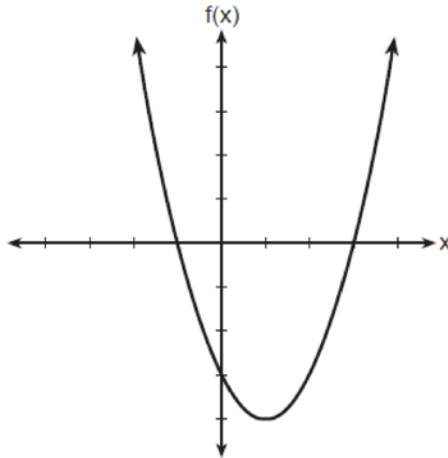
3) 60

2) 50

4) 75



15 The function  $f$  is graphed on the set of axes below.



What is a possible factorization of this function?

- 1)  $f(x) = (x - 1)(x + 3)$                       3)  $f(x) = (x + 1)(x - 4)$   
 2)  $f(x) = (x + 1)(x - 3)$                       4)  $f(x) = (x - 1)(x + 4)$

16 The range of  $f(x) = x^2 + 2x - 5$  is the set of all real numbers

- 1) less than or equal to  $-6$                       3) less than or equal to  $-1$   
 2) greater than or equal to  $-6$                       4) greater than or equal to  $-1$

17 Tables of values for four functions are shown below.

| x | f(x) |
|---|------|
| 0 | 6    |
| 1 | 7    |
| 2 | 10   |
| 3 | 15   |
| 4 | 22   |

| x | h(x) |
|---|------|
| 0 | 1    |
| 1 | 2    |
| 2 | 4    |
| 3 | 8    |
| 4 | 16   |

| x | g(x) |
|---|------|
| 0 | 0    |
| 1 | -2   |
| 2 | -2   |
| 3 | 0    |
| 4 | 4    |

| x | j(x) |
|---|------|
| 0 | 2    |
| 1 | 5    |
| 2 | 8    |
| 3 | 11   |
| 4 | 14   |

Which table best represents an exponential function?

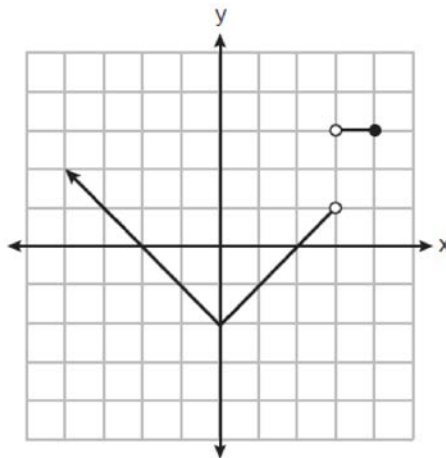
- 1)  $f(x)$     3)  $h(x)$   
 2)  $g(x)$     4)  $j(x)$



- 25 Classify the expression  $\frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3}$  as rational or irrational. Explain your reasoning.
- 26 Julia surveyed 150 of her classmates at City Middle School to determine their favorite animals. Of the 150 students, 46% were male. Forty-two students said their favorite animal was a horse, and of those students were female. Of the 60 students who said dolphins were their favorite animal, 30% were male. Using this information, complete the two-way frequency table below.

|        | Horse | Dolphin | Penguin | Total |
|--------|-------|---------|---------|-------|
| Male   |       |         |         |       |
| Female |       |         |         |       |
| Total  |       |         |         |       |

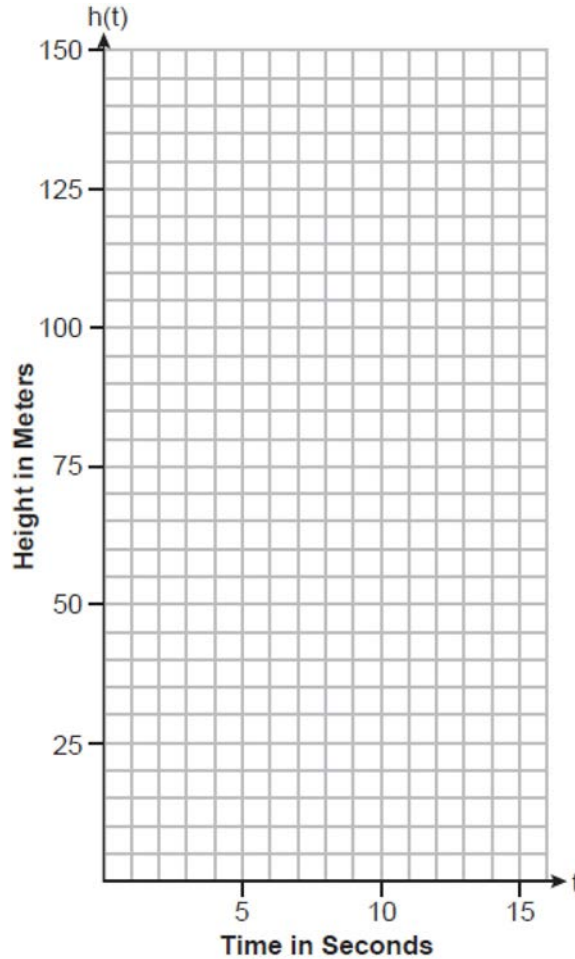
- 27 Bryan said that the piecewise function graphed below has a domain of all real numbers.



State *two* reasons why Bryan is *incorrect*.

- 28 The formula  $d = t \left( \frac{v_i + v_f}{2} \right)$  is used to calculate the distance,  $d$ , covered by an object in a given period of time,  $t$ . Solve the formula for  $v_f$ , the final velocity, in terms of  $d$ ,  $t$ , and  $v_i$ , the initial velocity.
- 29 Solve  $x^2 - 9x = 36$  algebraically for all values of  $x$ .
- 30 Determine the common difference of the arithmetic sequence in which  $a_1 = 5$  and  $a_5 = 17$ . Determine the 21<sup>st</sup> term of this sequence.
- 31 Factor  $18x^2 - 2$  completely.
- 32 Solve  $x^2 + 3x - 9 = 0$  algebraically for all values of  $x$ . Round your answer to the *nearest hundredth*.

- 33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs \$15.79, and a case of bottled water costs \$5.69. The senior class has \$125 to spend on the drinks. If  $x$  represents the number of cases of sports drinks and  $y$  represents the number of cases of bottled water purchased, write an inequality that models this situation. Nine cases of bottled water are purchased for this year's field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased. Explain your answer.
- 34 The path of a rocket is modeled by the function  $h(t) = -4.9t^2 + 49t$ , where  $h$  is the height, in meters, above the ground and  $t$  is the time, in seconds, after the rocket is launched. Sketch the graph on the set of axes below.



State the vertex of this function. Explain what the vertex means in the context of this situation.

- 35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

| <b>Annual Advertising Budget</b><br>(in thousands, \$)<br>( $x$ ) | <b>Profit</b><br>(in millions, \$)<br>( $y$ ) |
|---|---|
| 10  | 2.2   |
| 13  | 2.4   |
| 14  | 3.2   |
| 16  | 4.6   |
| 19  | 5.7   |
| 24  | 6.9   |
| 24  | 7.9   |
| 28  | 9.3   |

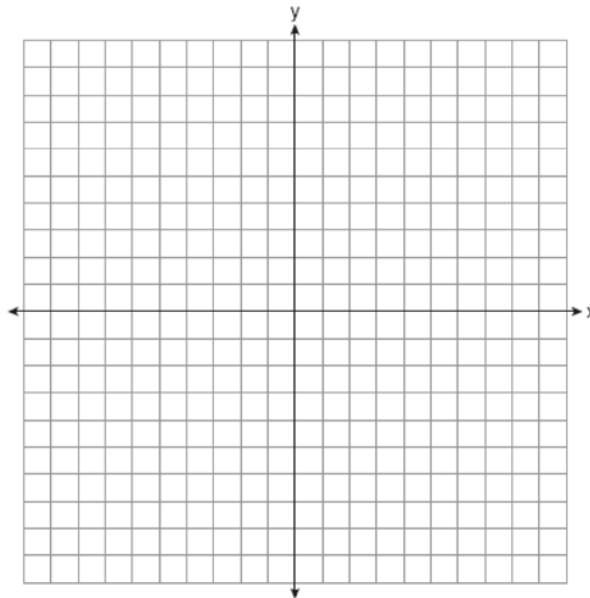
Write the linear regression equation for this set of data. State, to the *nearest hundredth*, the correlation coefficient of these linear data. State what this correlation coefficient indicates about the linear fit of the data.

- 36 Graph the following system of inequalities on the set of axes below:

$$-2y < 3x + 12$$

$$x \geq -3$$

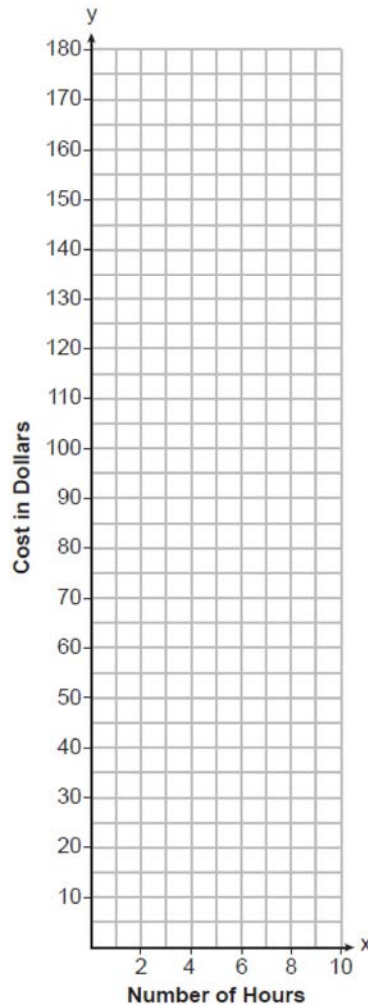
Label the solution set  $S$ .



Allison thinks that  $(2, -9)$  is a solution to this system. Determine if Allison is correct. Justify your answer.



- 37 Lydia wants to take art classes. She compares the cost at two art centers. Center *A* charges \$25 per hour and a registration fee of \$25. Center *B* charges \$15 per hour and a registration fee of \$75. Lydia plans to take  $x$  hours of classes. Write an equation that models this situation, where  $A$  represents the total cost of Center *A*. Write an equation that models this situation, where  $B$  represents the total cost of Center *B*. If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost *less*. Graph your equations for Center *A* and Center *B* on the set of axes below.



State the number of hours of classes when the centers will cost the same.

## 0823AI

## Answer Section

- 1 ANS: 3                      PTS: 2                      REF: 082301ai                      NAT: F.IF.B.4  
TOP: Relating Graphs to Events
- 2 ANS: 3  
 $(3x^2 + 4x - 8) + 22 - 10x = 3x^2 - 6x + 14$
- PTS: 2                      REF: 082302ai                      NAT: A.APR.A.1                      TOP: Operations with Polynomials  
KEY: addition
- 3 ANS: 1  
 $(-3)^3 - 2(-3) = -27 + 6 = -21$
- PTS: 2                      REF: 082303ai                      NAT: A.REI.D.10                      TOP: Identifying Solutions
- 4 ANS: 2  
 $\frac{5(2x - 4)}{3} = 5$   
 $10x - 20 = 15$   
 $10x = 35$   
 $x = 3.5$
- PTS: 2                      REF: 082304ai                      NAT: A.REI.B.3                      TOP: Solving Linear Equations
- 5 ANS: 1                      PTS: 2                      REF: 082305ai                      NAT: F.BF.B.3  
TOP: Graphing Polynomial Functions                      KEY: bimodalgraph
- 6 ANS: 1                      PTS: 2                      REF: 082306ai                      NAT: A.CED.A.1  
TOP: Geometric Applications of Quadratics
- 7 ANS: 3  
The value of the third quartile is the last vertical line of the box.
- PTS: 2                      REF: 082307ai                      NAT: S.ID.A.1                      TOP: Box Plots  
KEY: interpret
- 8 ANS: 2  
 $(2x + 7)(x - 3) = 2x^2 - 6x + 7x - 21 = 2x^2 + x - 21$
- PTS: 2                      REF: 082308ai                      NAT: A.APR.A.1                      TOP: Operations with Polynomials  
KEY: multiplication
- 9 ANS: 3                      PTS: 2                      REF: 082309ai                      NAT: A.SSE.A.1  
TOP: Modeling Expressions

- 10 ANS: 2  
 $-3(x - 6) > 2x - 2$   
 $-3x + 18 > 2x - 2$   
 $20 > 5x$   
 $4 > x$
- PTS: 2 REF: 082310ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities
- 11 ANS: 4  
 Each expression equals  $x^9$ .
- PTS: 2 REF: 082311ai NAT: A.APR.A.1 TOP: Powers of Powers
- 12 ANS: 3 PTS: 2 REF: 082312ai NAT: F.LE.B.5  
 TOP: Modeling Exponential Functions
- 13 ANS: 3  
 $m(x) = x(x + 4)(x - 4)$
- PTS: 2 REF: 082313ai NAT: A.APR.B.3 TOP: Zeros of Polynomials
- 14 ANS: 4  
 $f(0) = 3, g(0) = 4, h(0) = 2, k(0) = 1$
- PTS: 2 REF: 082314ai NAT: F.IF.C.9 TOP: Comparing Functions
- 15 ANS: 2 PTS: 2 REF: 082315ai NAT: F.IF.C.7  
 TOP: Graphing Quadratic Functions KEY: key features
- 16 ANS: 2  
 $x = \frac{-2}{2(1)} = -1; f(-1) = (-1)^2 + 2(-1) - 5 = -6$
- PTS: 2 REF: 082316ai NAT: F.IF.A.2 TOP: Domain and Range
- 17 ANS: 3  
 $h(x) = 2^x$
- PTS: 2 REF: 082317ai NAT: F.LE.A.1 TOP: Families of Functions
- 18 ANS: 4  
 $f(-1) = f(-2) = -2$
- PTS: 2 REF: 082318ai NAT: F.IF.A.2 TOP: Functional Notation
- 19 ANS: 1 PTS: 2 REF: 082319ai NAT: F.BF.A.1  
 TOP: Sequences KEY: recursive

20 ANS: 2

$$x^2 - 6x + 9 = -4 + 9$$

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

$$(x - 3)^2 = 5$$

PTS: 2 REF: 082320ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: completing the square

21 ANS: 1

$$y + 3 = -\frac{4}{3}(x - 6)$$

$$3y + 9 = -4x + 24$$

$$3y = -4x + 15$$

PTS: 2 REF: 082321ai NAT: A.REI.D.10 TOP: Writing Linear Equations

KEY: other forms

22 ANS: 4 PTS: 2 REF: 082322ai NAT: F.IF.B.5

TOP: Domain and Range

KEY: context

23 ANS: 4

$$\frac{53 - 1129}{2013 - 2006} \approx -153.71$$

PTS: 2 REF: 082323ai NAT: F.IF.B.6 TOP: Rate of Change

24 ANS: 1 PTS: 2 REF: 082324ai NAT: N.Q.A.1

TOP: Conversions

25 ANS:

$$\frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} = \frac{2}{12} + \frac{13}{3} \text{ The sum of two rational numbers is rational.}$$

PTS: 2 REF: 082325ai NAT: N.RN.B.3 TOP: Operations with Radicals

KEY: classify

26 ANS:

|        | Horse | Dolphin | Penguin | Total |
|--------|-------|---------|---------|-------|
| Male   | 28    | 18      | 23      | 69    |
| Female | 14    | 42      | 25      | 81    |
| Total  | 42    | 60      | 48      | 150   |

PTS: 2 REF: 082326ai NAT: S.ID.B.5 TOP: Frequency Tables

KEY: two-way

27 ANS:

The function is not defined at  $x = 3$  or  $x > 4$ .

PTS: 2 REF: 082327ai NAT: F.IF.A.2 TOP: Domain and Range

28 ANS:

$$2d = t(v_i + v_f)$$

$$\frac{2d}{t} = v_i + v_f$$

$$\frac{2d}{t} - v_i = v_f$$

PTS: 2 REF: 082328ai NAT: A.CED.A.4 TOP: Transforming Formulas

29 ANS:

$$x^2 - 9x - 36 = 0$$

$$(x - 12)(x + 3) = 0$$

$$x = 12, -3$$

PTS: 2 REF: 082329ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: factoring

30 ANS:

$$d = \frac{17-5}{5-1} = 3; a_{21} = 5 + (21-1)(3) = 65$$

PTS: 2 REF: 082330ai NAT: F.IF.A.3 TOP: Sequences

KEY: explicit

31 ANS:

$$18x^2 - 2 = 2(9x^2 - 1) = 2(3x + 1)(3x - 1)$$

PTS: 2 REF: 082331ai NAT: A.SSE.A.2

TOP: Factoring the Difference of Perfect Squares

32 ANS:

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-9)}}{2(1)} = \frac{-3 \pm \sqrt{45}}{2} \approx -4.85, 1.85$$

PTS: 2 REF: 082332ai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: quadratic formula

33 ANS:

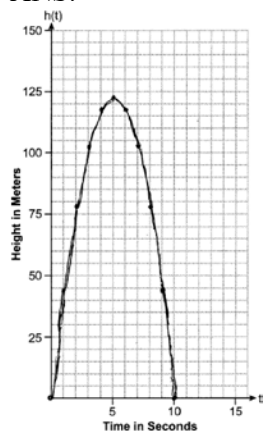
$$15.79x + 5.69y \leq 125 \quad 15.79x + 5.69(9) \leq 125 \quad 4 \text{ cases can be bought. Buying 5 cases totals more than } \$125.$$

$$15.79x \leq 73.79$$

$$x \leq 4.7$$

PTS: 4 REF: 082333ai NAT: A.CED.A.3 TOP: Modeling Linear Inequalities

34 ANS:



(5,122.5) The rocket is at 122.5m at 5 sec.

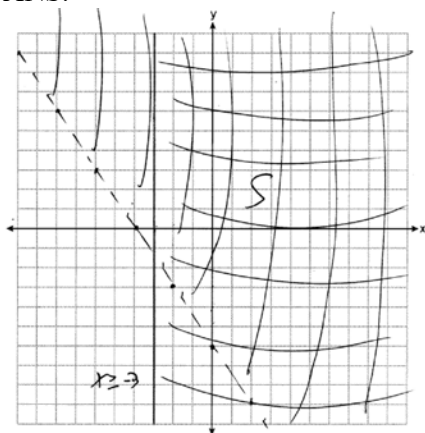
PTS: 4 REF: 082334ai NAT: F.IF.B.4 TOP: Graphing Quadratic Functions  
 KEY: graph

35 ANS:

$y = 0.41x - 2.31$ , 0.99, strong

PTS: 4 REF: 082335ai NAT: S.ID.B.6 TOP: Regression  
 KEY: linear with correlation coefficient

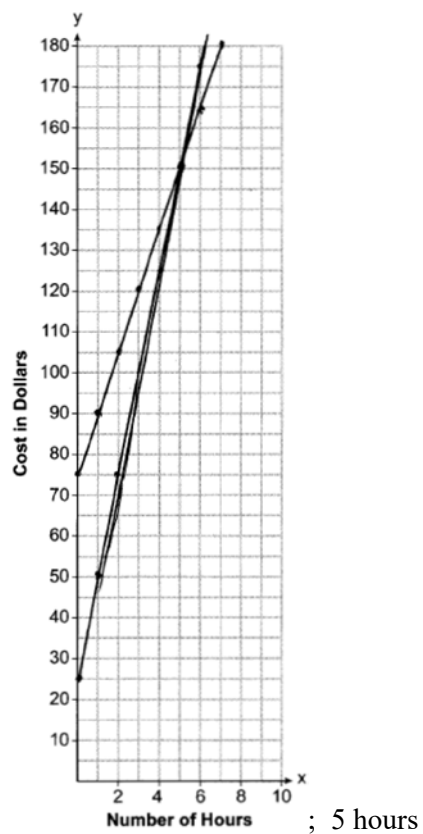
36 ANS:



No, as  $-2(-9) = 3(2) + 12$ .

PTS: 4 REF: 082336ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities

37 ANS:



$$a = 25x + 25; \quad a = 25(10) + 25 = 275 \quad b \text{ will cost less;}$$

$$b = 15x + 75 \quad b = 15(10) + 75 = 225$$

PTS: 6

REF: 082337ai

NAT: A.REI.C.6

TOP: Graphing Linear Systems