

## 0624AI

- 1 A ball was launched into the air, and its height above the ground was recorded each second, as shown in the table below.

Time (sec)	0	1	2	3	4
Height (ft)	11	59	75	59	11

Based on these data, which statement is a valid conclusion?

- 1) The ball lands on the ground at 4 seconds.
  - 2) The ball reaches a maximum height of 11 feet.
  - 3) The ball was launched from a height of 0 feet.
  - 4) The ball reaches its maximum height at 2 seconds.
- 2 A tour bus can seat, at most, 48 passengers. An adult ticket costs \$18 and a child ticket costs \$12. The bus company must collect at least \$650 to make a profit. If  $a$  represents the number of adult tickets sold and  $c$  represents the number of child tickets sold, which system of inequalities models this situation if they make a profit?
- 1)  $a + c < 48$   
 $18a + 12c > 650$
  - 2)  $a + c \leq 48$   
 $18a + 12c \geq 650$
  - 3)  $a + c < 48$   
 $18a + 12c < 650$
  - 4)  $a + c \leq 48$   
 $18a + 12c \leq 650$
- 3 Which equation is always true?
- 1)  $x^2 \bullet x^3 = x^5$
  - 2)  $3^x \bullet 3^2 = 9^{2x}$
  - 3)  $-z^2 = z^2$
  - 4)  $7^a \bullet 7^b = 7^{ab}$
- 4 The expression  $-2(x^2 - 2x + 1) + (3x^2 + 3x - 5)$  is equivalent to
- 1)  $x^2 + x - 4$
  - 2)  $x^2 - x - 7$
  - 3)  $x^2 + 7x - 4$
  - 4)  $x^2 + 7x - 7$
- 5 Which sum is irrational?
- 1)  $-2\sqrt{12} + \sqrt{100}$
  - 2)  $-\sqrt{4} + \frac{1}{3}\sqrt{900}$
  - 3)  $\frac{1}{2}\sqrt{25} + \sqrt{64}$
  - 4)  $\sqrt{49} + 3\sqrt{121}$
- 6 The solution to  $\frac{4(x-5)}{3} + 2 = 14$  is
- 1) 15
  - 2) 14
  - 3) 6
  - 4) 4
- 7 On an island, a rare breed of rabbit doubled its population each month for two years. Which type of function best models the increase in population at the end of two years?
- 1) linear growth
  - 2) linear decay
  - 3) exponential growth
  - 4) exponential decay

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- Box plot of Winter of 2021 Snowfall (inches). The plot shows a distribution with a minimum at 50, Q1 at 60, Median at 80, Q3 at 110, and Maximum at 120. The x-axis is labeled 'Winter of 2021 Snowfall (inches)' and ranges from 0 to 140.

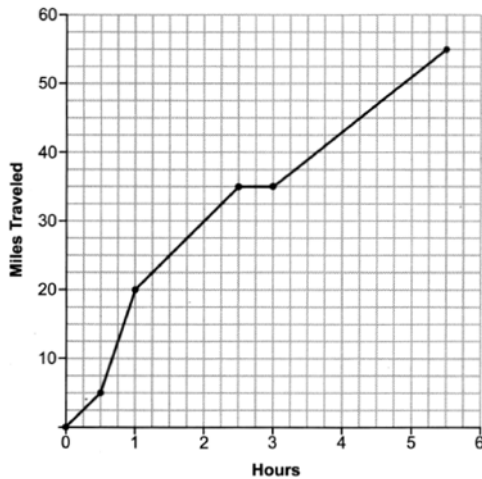
- 1) 30
- 2) 50
- 3) 80
- 4) 110

I

### III

IV

18 One Saturday, Dave took a long bike ride. The graph below models his trip.



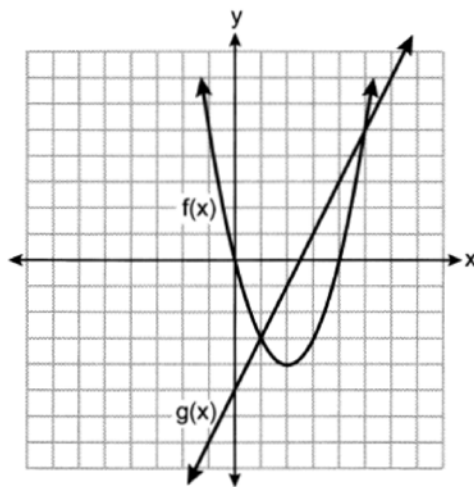
What was Dave's average rate of change, in miles per hour, on this trip?

- |       |         |
|-------|---------|
| 1) 10 | 3) 11.6 |
| 2) 11 | 4) 14.5 |

19 Which expression is equivalent to  $(x - 5)(2x + 7) - (x + 5)$ ?

- |                     |                     |
|---------------------|---------------------|
| 1) $2x^2 - 2x - 30$ | 3) $2x^2 - 4x - 30$ |
| 2) $2x^2 - 2x - 40$ | 4) $2x^2 - 4x - 40$ |

20 The functions  $f(x)$  and  $g(x)$  are graphed on the set of axes below.



What is the solution to the equation  $f(x) = g(x)$ ?

- |             |             |
|-------------|-------------|
| 1) 1 and 5  | 3) -3 and 5 |
| 2) -5 and 0 | 4) 0 and 4  |

- 21 When babysitting, Nicole charges an hourly rate and an additional charge for gas. She uses the function  $C(h) = 6h + 5$  to determine how much to charge for babysitting. The constant term of this function represents
- the additional charge for gas
  - the hourly rate Nicole charges
  - the number of hours Nicole babysits
  - the total Nicole earns from babysitting
- 22 When solved for  $x$  in terms of  $a$ , the solution to the equation  $3x - 7 = ax + 5$  is
- $\frac{12}{3a}$
  - $\frac{12}{3-a}$
  - $\frac{3a}{12}$
  - $\frac{3-a}{12}$
- 23 Wayde van Niekerk, a runner from South Africa, ran 400 meters in 43.03 seconds to set a world record. Which calculation would determine his average speed, in miles per hour?
- $\frac{400 \text{ m}}{43.03 \text{ sec}} \cdot \frac{1000 \text{ m}}{0.62 \text{ mi}} \cdot \frac{1 \text{ hr}}{3600 \text{ sec}}$
  - $\frac{400 \text{ m}}{43.03 \text{ sec}} \cdot \frac{0.62 \text{ mi}}{1000 \text{ m}} \cdot \frac{1 \text{ hr}}{3600 \text{ sec}}$
  - $\frac{400 \text{ m}}{43.03 \text{ sec}} \cdot \frac{0.62 \text{ mi}}{1000 \text{ m}} \cdot \frac{3600 \text{ sec}}{1 \text{ hr}}$
  - $\frac{400 \text{ m}}{43.03 \text{ sec}} \cdot \frac{1000 \text{ m}}{0.62 \text{ mi}} \cdot \frac{3600 \text{ sec}}{1 \text{ hr}}$
- 24 Which function has a domain of all real numbers and a range greater than or equal to three?
- $f(x) = -x + 3$
  - $g(x) = x^2 + 3$
  - $h(x) = 3^x$
  - $m(x) = |x + 3|$
- 25 Solve  $5(x - 2) \leq 3x + 20$  algebraically.
- 26 Given  $g(x) = x^3 + 2x^2 - x$ , evaluate  $g(-3)$ .
- 27 Given the relation  $R = \{(-1, 1), (0, 3), (-2, -4), (x, 5)\}$ . State a value for  $x$  that will make this relation a function. Explain why your answer makes this a function.
- 28 A survey of 150 students was taken. It was determined that  $\frac{2}{3}$  of the students play video games. Of the students that play video games, 85 also use social media. Of the students that do not play video games, 20% do not use social media. Complete the two-way frequency table.

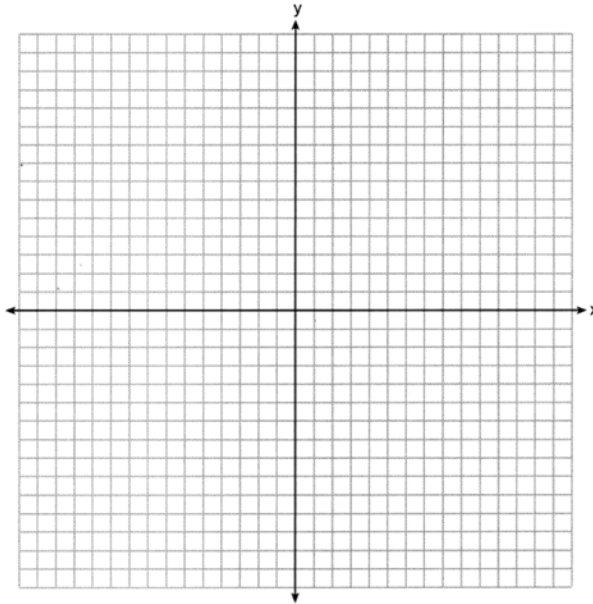
	Play Video Games	Do Not Play Video Games	Total
Social Media			
No Social Media			
Total			

- 29 Use the method of completing the square to determine the exact values of  $x$  for the equation  $x^2 + 10x - 30 = 0$ .
- 30 Factor  $20x^3 - 45x$  completely.

- 31 Graph the following system of equations on the set of axes below.

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

$$y = x - 1$$



State the coordinates of all solutions.

- 32 The table below shows the amount of money a popular movie earned, in millions of dollars, during its first six weeks in theaters.

Week (x)	1	2	3	4	5	6
Dollars Earned, in Millions (y)	185	150	90	50	25	5

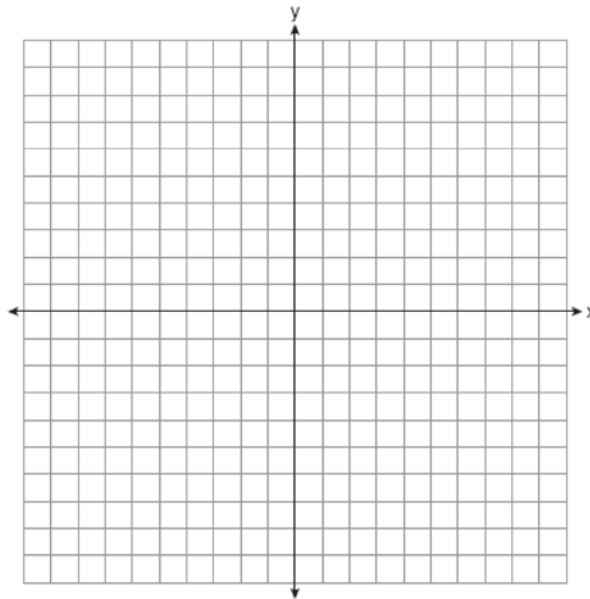
Write the linear regression equation for this data set, rounding all values to the *nearest hundredth*. State the correlation coefficient to the *nearest hundredth*. State what this correlation coefficient indicates about the linear fit of the data.

- 33 Use the quadratic formula to solve the equation  $3x^2 - 10x + 5 = 0$ . Express the answer in simplest radical form.

- 34 Graph the system of inequalities on the set of axes below.

$$3y + 2x \leq 15$$

$$y - x > 1$$



State the coordinates of a point in the solution to this system. Justify your answer.

- 35 Courtney went to a coffee shop to purchase lattes and donuts for her friends. One day she spent a total of \$15.50 on four lattes and two donuts. The next day she spent a total of \$18.10 on three lattes and five donuts. All prices included tax. If  $x$  represents the cost of one latte and  $y$  represents the cost of one donut, write a system of equations that can be used to model this situation. Courtney thinks that one latte costs \$2.75 and one donut costs \$2.25. Is Courtney correct? Justify your answer. Use your equations to determine algebraically the exact cost of one latte and the exact cost of one donut.

## 0624AI

## Answer Section

- 1 ANS: 4 PTS: 2 REF: 062401ai NAT: F.IF.B.4  
TOP: Graphing Quadratic Functions KEY: key features
- 2 ANS: 2 PTS: 2 REF: 062402ai NAT: A.CED.A.3  
TOP: Modeling Systems of Linear Inequalities
- 3 ANS: 1 PTS: 2 REF: 062403ai NAT: A.APR.A.1  
TOP: Multiplication of Powers
- 4 ANS: 4  
 $-2x^2 + 4x - 2 + 3x^2 + 3x - 5 = x^2 + 7x - 7$   
  
PTS: 2 REF: 062404ai NAT: A.APR.A.1 TOP: Operations with Polynomials  
KEY: addition
- 5 ANS: 1 PTS: 2 REF: 062405ai NAT: N.RN.B.3  
TOP: Operations with Radicals KEY: classify
- 6 ANS: 2  
 $\frac{4(x-5)}{3} = 12$   
 $4x - 20 = 36$   
 $4x = 56$   
 $x = 14$   
  
PTS: 2 REF: 062406ai NAT: A.REI.B.3 TOP: Solving Linear Equations
- 7 ANS: 3 PTS: 2 REF: 062407ai NAT: F.LE.A.1  
TOP: Families of Functions
- 8 ANS: 3 PTS: 2 REF: 062408ai NAT: A.SSE.A.1  
TOP: Modeling Expressions
- 9 ANS: 2 PTS: 2 REF: 062409ai NAT: A.APR.B.3  
TOP: Zeros of Polynomials
- 10 ANS: 3  
 $\frac{5-1}{-1-2} = \frac{6}{-3} = -2$   $5 = -2(-1) + b$   
 $3 = b$   
  
PTS: 2 REF: 062410ai NAT: F.IF.B.4 TOP: Graphing Linear Functions
- 11 ANS: 1  
 $a(8) = 2^8 + 25 = 281$   $b(8) = 10(8) + 75 = 155$   $c(8) = \sqrt{400(8)} + 80 \approx 137$   $d(8) = 2(8+1)^2 - 10(8) + 50 = 132$   
  
PTS: 2 REF: 062411ai NAT: F.LE.A.3 TOP: Families of Functions



12 ANS: 2

$$25r^2 = 625$$

$$r^2 = 25$$

$$r = \pm 5$$

PTS: 2

REF: 062412ai

NAT: F.IF.A.3

TOP: Sequences

KEY: difference or ratio

13 ANS: 2

$$110 - 60 = 50$$

PTS: 2

REF: 062413ai

NAT: S.ID.A.1

TOP: Box Plots

KEY: interpret

14 ANS: 1

$$1) -7; 2) -4; 3) x = \frac{-6}{2(1)} = -3, c(-3) = (-3)^2 + 6(-3) + 3 = -6; 4) -5$$

PTS: 2

REF: 062414ai

NAT: F.IF.C.9

TOP: Comparing Quadratic Functions

15 ANS: 2

PTS: 2

REF: 062415ai

NAT: F.BF.A.1

TOP: Sequences

KEY: explicit

16 ANS: 2

$$\text{mean: } \frac{3(0) + 3(1) + 4(2) + 5(3) + 2(4) + 2(5) + 1(6)}{3 + 3 + 4 + 5 + 2 + 2 + 1} = \frac{50}{20} = 2.5, \text{ mode: } 3, \text{ median: } \frac{2+3}{2} = 2.5$$

PTS: 2

REF: 062416ai

NAT: S.ID.A.1

TOP: Dot Plots

17 ANS: 4

PTS: 2

REF: 062417ai

NAT: F.BF.B.3

TOP: Transformations with Functions

18 ANS: 1

$$\frac{55-0}{5.5-0} = 10$$

PTS: 2

REF: 062418ai

NAT: F.IF.B.6

TOP: Rate of Change

19 ANS: 4

$$2x^2 + 7x - 10x - 35 - x - 5 = 2x^2 - 4x - 40$$

PTS: 2

REF: 062419ai

NAT: A.APR.A.1

TOP: Operations with Polynomials

KEY: multiplication

20 ANS: 1

PTS: 2

REF: 062420ai

NAT: A.REI.D.11

TOP: Quadratic-Linear Systems

21 ANS: 1

PTS: 2

REF: 062421ai

NAT: F.LE.B.5

TOP: Modeling Linear Functions

22 ANS: 2  
 $3x - ax = 12$   
 $x(3 - a) = 12$

$$x = \frac{12}{3 - a}$$

PTS: 2 REF: 062422ai NAT: A.REI.B.3 TOP: Solving Linear Equations

KEY: coefficients represented by letters

23 ANS: 3 PTS: 2 REF: 062423ai NAT: N.Q.A.1  
 TOP: Conversions

24 ANS: 2  
 All four functions have a real domain.  $f$  has a real range.  $h$  has a positive real range.  $m$  has a nonnegative real range.

PTS: 2 REF: 062424ai NAT: F.IF.A.2 TOP: Domain and Range

25 ANS:  
 $5x - 10 \leq 3x + 20$   
 $2x \leq 30$   
 $x \leq 15$

PTS: 2 REF: 062425ai NAT: A.REI.B.3 TOP: Solving Linear Inequalities

26 ANS:  
 $g(-3) = (-3)^3 + 2(-3)^2 - (-3) = -27 + 18 + 3 = -6$

PTS: 2 REF: 062426ai NAT: F.IF.A.2 TOP: Functional Notation

27 ANS:  
 $x$  may be any value other than  $-2, -1, 0$ , so that for any value of  $x$ , there is a unique  $y$ .

PTS: 2 REF: 062427ai NAT: F.IF.A.1 TOP: Defining Functions

28 ANS:

	Play Video Games	Do Not Play Video Games	Total
Social Media	85	40	125
No Social Media	15	10	25
Total	100	50	150

PTS: 2 REF: 062428ai NAT: S.ID.B.5 TOP: Frequency Tables

KEY: two-way

29 ANS:

$$x^2 + 10x = 30$$

$$x^2 + 10x + 25 = 30 + 25$$

$$(x + 5)^2 = 55$$

$$x + 5 = \pm\sqrt{55}$$

$$x = -5 \pm \sqrt{55}$$

PTS: 2

REF: 062429ai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: completing the square

30 ANS:

$$20x^3 - 45x = 5x(4x^2 - 9) = 5x(2x + 3)(2x - 3)$$

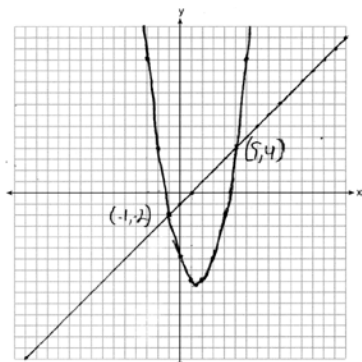
PTS: 2

REF: 062430ai

NAT: A.SSE.A.2

TOP: Factoring the Difference of Perfect Squares

31 ANS:



PTS: 4

REF: 062431ai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

32 ANS:

$$y = -37.57x + 215.67, -0.98, \text{strong}$$

PTS: 4

REF: 062432ai

NAT: S.ID.B.6

TOP: Regression

KEY: linear with correlation coefficient

33 ANS:

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(3)(5)}}{2(3)} = \frac{10 \pm \sqrt{40}}{6} = \frac{10 \pm 2\sqrt{10}}{6} = \frac{5 \pm \sqrt{10}}{3}$$

PTS: 4

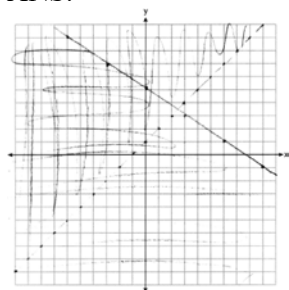
REF: 062433ai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: quadratic formula

34 ANS:



$(-1, 1)$  is a solution as it is in the overlap area.

PTS: 4

REF: 062434ai

NAT: A.REI.D.12

TOP: Graphing Systems of Linear Inequalities

35 ANS:

$4x + 2y = 15.5$   $5(4x + 2y = 15.5)$  Courtney is incorrect because of the following calculations:  $20x + 10y = 77.5$

$3x + 5y = 18.1$   $2(3x + 5y = 18.1)$

$6x + 10y = 36.2$

$14x = 41.3$

$x = 2.95$

$4(2.95) + 2y = 15.5$

$11.8 + 2y = 15.5$

$2y = 3.7$

$y = 1.85$

PTS: 6

REF: 062435ai

NAT: A.CED.A.3

TOP: Modeling Linear Systems