## 0825AI

1 Which expression is equivalent to $100x^2 - 16$?
1) $(50x - 8)(50x + 8)$
3) $(10x - 4)(10x + 4)$
2) $(50x - 8)(50x - 8)$
4) $(10x - 4)(10x - 4)$

2 Josie has \$2.30 in dimes and quarters. She has two more dimes than quarters. Which equation below can be used to determine $x$, the number of quarters she has?
1) $0.35(2x + 2) = 2.30$
3) $0.25x + 0.10(x + 2) = 2.30$
2) $0.25(x + 2) + 0.10x = 2.30$
4) $0.25x + 0.10(x - 2) = 2.30$

3 If $g(x) = -2x^2 + 16$ then $g(-3)$ equals
1) $-20$
3) $34$
2) $-2$
4) $52$

4 What are the zeros of $f(x) = x^2 - 8x - 20$?
1) 10 and 2
3) $-10$ and 2
2) 10 and $-2$
4) $-10$ and $-2$

5 Which point lies on the graph of $y = 3x^2 - \frac{1}{4}x + 3$?
1) $(-2, 15.5)$
3) $(1, 6.25)$
2) $(-1, 5.75)$
4) $(2, 15.5)$

6 Given $f(x) = x^2$ and $g(x) = 8x - 15$ graphed on the same set of axes, which value(s) of $x$ will make $f(x) = g(x)$?
1) 3, only
3) 3 and 5
2) 9, only
4) 9 and 25

7 Which trinomial is written in standard form and has a constant term of five?
1) $x^5 - 4x^2 + 10$
3) $5x^4 - 3x^2 + 1$
2) $2x^2 + 6x^4 + 5$
4) $4x^5 - 8x^2 + 5$

8 When solving $x^2 + 6x = -8$ for $x$, a student wrote $x^2 + 6x + 8 = 0$ as their first step. Which property justifies this step?
1) associative property
3) zero property of addition
2) commutative property
4) addition property of equality

9 The tables below show the input and output values of four different functions.

| x | f(x) |
|---|---|
| −2 | 6 |
| −1 | 1 |
| 0 | −2 |
| 1 | −3 |
| 2 | −2 |
| 3 | 1 |

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

| x | h(x) |
|---|---|
| −2 | −1 |
| −1 | −2 |
| 0 | −4 |
| 1 | −8 |
| 2 | −16 |
| 3 | −32 |

| x | j(x) |
|---|---|
| −3 | −11 |
| −2 | −7 |
| −1 | −3 |
| 0 | 1 |
| 1 | 5 |
| 2 | 9 |

Which table represents a linear function?·
1) $f(x)$
2) $g(x)$
3) $h(x)$
4) $j(x)$

10 What is the solution set to the equation $3x^2 = 24x$?
1) {8}
2) {0, 8}
3) {0, −8}
4) {0, 8, −8}

11 The table below shows the radioactivity level of a substance after the given time, $t$, in seconds.

| Time (seconds) | Radioactivity Level |
|---|---|
| 0 | 20 |
| 1 | 10 |
| 2 | 5 |
| 3 | 2.5 |
| 4 | 1.25 |

What is the average rate of change in radioactivity level over the interval $1 \le t \le 3$?
1) 3.75
2) −3.75
3) 4.6875
4) −4.6875

12 Fred recorded the number of minutes he read each day, from Monday through Friday. His results are shown in the table.

| Day | Number of Minutes Read |
|---|---|
| 1 | 12 |
| 2 | 16 |
| 3 | 19 |
| 4 | 27 |
| 5 | 29 |

What is the correlation coefficient, to the *nearest thousandth*, and strength of the linear model of these data?
1) 0.984 and strong
2) 0.968 and strong
3) 0.984 and weak
4) 0.968 and weak

13 Given $f(x) = x^2$, which function will shift $f(x)$ to the left 3 units?

1) $g(x) = x^2 + 3$

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

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

4) $k(x) = (x + 3)^2$

14 A class of 20 students was surveyed to determine the number of pets each student owned. The data are represented in the dot plot below.



**Number of Pets**

Which statement about the data is correct?

1) The mean and the median are the same.

2) The median and the mode are the same.

3) The mean and the mode are the same.

4) The mean, median, and mode are all the same.

15 The range of $f(x) = |x + 2| - 5$ is

1) $y \geq -5$

2) $y \geq 2$

3) $x \geq -5$

4) $x \geq 2$

16 Which equation is always correct?

1) $a^3 \cdot a^x = a^{3x}$

2) $(a^4)^x = a^{4+x}$

3) $(ab)^x = a^x b^x$

4) $a^x \cdot b^y = ab^{x+y}$

17 The formula for the area of a trapezoid is $A = \dfrac{1}{2} h(b_1 + b_2)$. The height, $h$, of the trapezoid may be expressed as

1) $\dfrac{2A}{b_1 + b_2}$

2) $\dfrac{1}{2} A(b_1 + b_2)$

3) $\dfrac{b_1 + b_2}{2A}$

4) $\dfrac{1}{2} A - (b_1 + b_2)$

18 Three functions are given below.

| x | h(x) |
|---|---|
| −4 | 5 |
| −3 | 0 |
| −2 | −3 |
| −1 | −4 |
| 0 | −3 |
| 1 | 0 |
| 2 | 5 |

$$f(x) = -|x + 2| + 7$$

$$g(x) = (x - 3)^2 - 4$$

Which functions have the same $y$-intercept?
1) $f(x)$ and $g(x)$
2) $g(x)$ and $h(x)$
3) $f(x)$ and $h(x)$
4) The functions all have different $y$-intercepts.

19 The sum of $(x + 7)^2$ and $(x - 3)^2$ is
1) $2x^2 + 58$
2) $2x^4 + 58$
3) $2x^2 + 8x + 58$
4) $2x^4 + 8x^2 + 58$

20 The product of $2\sqrt{10}$ and $3\sqrt{2}$ is
1) $12\sqrt{5}$
2) $5\sqrt{20}$
3) $24\sqrt{5}$
4) $5\sqrt{12}$

21 When $6x^3 - 2x + 8$ is subtracted from $5x^3 + 3x - 4$, the result is
1) $x^3 - 5x + 12$
2) $x^3 + x + 4$
3) $-x^3 + 5x - 12$
4) $-x^3 + x + 4$

22 Three relations are shown below.

I. {(0,1), (1,2), (2,3), (3,4)}

III.

II.
| 3 → 3 |
| 4 → 4 |
| 5 → 5 |
| 6 → 6 |
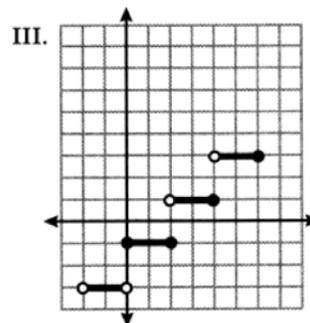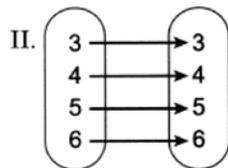


Which relations represent a function?
1) I and II, only
2) I and III, only
3) II and III, only
4) I, II, and III

23 The method of substitution was used to solve the system of equations below:

$$4x - 7y = 7$$

$$x - y = -1$$

Which equation is a correct first step when using this method?
1) $x = y - 1$ 　　　　　　　　　3) $3x - 6y = 8$
2) $y = x - 1$ 　　　　　　　　　4) $5x - 8y = 6$

24 In 2009, Usain Bolt, a sprinter from Jamaica, set the world record in the 100-meter dash with a time of 9.58 seconds. His approximate speed, in kilometers per hour, can be found using which conversion?

1) $\dfrac{9.58 \text{ sec}}{100 \text{ m}} \cdot \dfrac{1000 \text{ m}}{1 \text{ km}} \cdot \dfrac{1 \text{ min}}{60 \text{ sec}} \cdot \dfrac{1 \text{ hr}}{60 \text{ min}}$ 　　　3) $\dfrac{100 \text{ m}}{9.58 \text{ sec}} \cdot \dfrac{1 \text{ km}}{1000 \text{ m}} \cdot \dfrac{1 \text{ min}}{60 \text{ sec}} \cdot \dfrac{1 \text{ hr}}{60 \text{ min}}$

2) $\dfrac{100 \text{ m}}{9.58 \text{ sec}} \cdot \dfrac{60 \text{ sec}}{1 \text{ min}} \cdot \dfrac{1000 \text{ m}}{1 \text{ km}} \cdot \dfrac{60 \text{ min}}{1 \text{ hr}}$ 　　　4) $\dfrac{100 \text{ m}}{9.58 \text{ sec}} \cdot \dfrac{60 \text{ sec}}{1 \text{ min}} \cdot \dfrac{1 \text{ km}}{1000 \text{ m}} \cdot \dfrac{60 \text{ min}}{1 \text{ hr}}$

25 Solve the equation $\dfrac{1}{6}(4x + 2) = 9$ algebraically.

26 Is the sum of $3\sqrt{2}$ and 5 rational or irrational? Explain your answer.

27 Graph $h(x) = |x - 2|$ over the domain $-4 \le x \le 4$.

28  A survey was given to 180 cell phone owners about the brand of phone they owned.  The results showed that 59 adults owned Brand $B$ and 32 teenagers owned Brand $A$.  Of all the people surveyed, 40% owned Brand $A$. Complete the two-way frequency table below.

|  | Brand A | Brand B | Total |
|---|---|---|---|
| Adults |  |  |  |
| Teenagers |  |  |  |
| Total |  |  |  |

29  Determine the 8th term of a geometric sequence whose first term is 5 and whose common ratio is 3.

30  Using the method of completing the square, express $x^2 + 14x - 28 = 0$ in the form $(x-p)^2 = q$.

31  Graph $f(x) = -\dfrac{1}{3}x^2 + 4$ on the set of axes below.
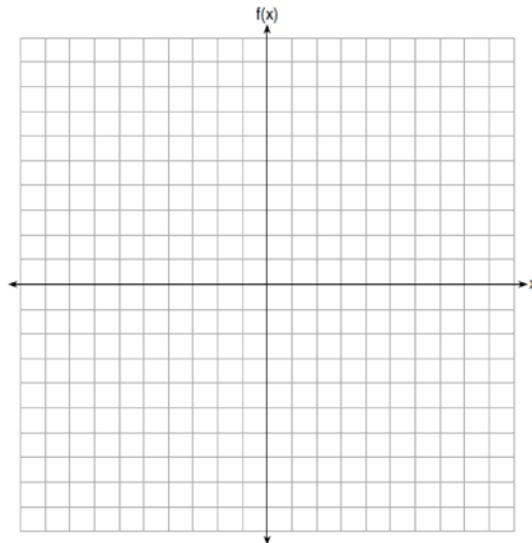


State the vertex of this function.  State the equation of the axis of symmetry of this function.

32  Vince wants to rent a canoe while he is on vacation.  The canoe rental company charges $18 for the first hour and $7.50 for each additional hour, $x$.  If Vince has $78 to spend on renting a canoe, write an inequality in terms of $x$ that models this situation.  Algebraically determine the maximum number of hours that Vince could rent a canoe.

33  Graph the following system of inequalities on the set of axes below:

$$y \geq -\frac{1}{2}x - 3$$

$$y - 2x < 5$$
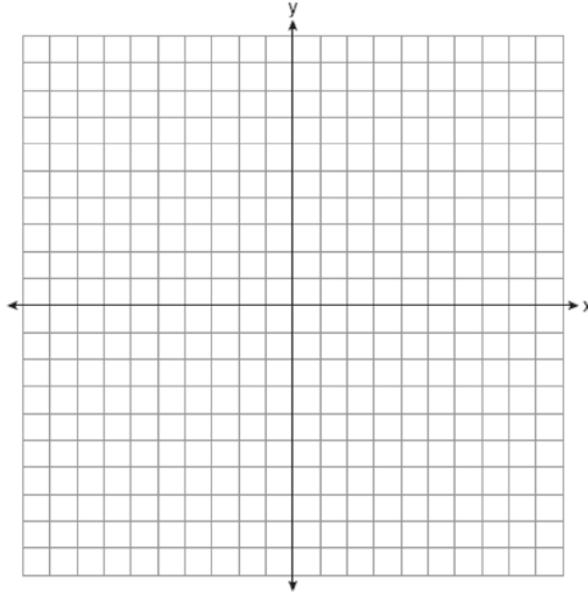


State the coordinates of a point that is in the solution to this system.  Justify your answer.

34  Using the quadratic formula, solve $x^2 - 6x + 3 = 0$.  Express the answer in simplest radical form.

35  Cameron sold hot dogs and sodas at a concession stand.  He sold a total of 25 items for $45.00.  A hot dog sold for $2.25 and a soda sold for $1.50.  All prices include tax.  If $x$ represents the number of hot dogs sold and $y$ represents the number of sodas sold, write a system of equations that models this situation.  Determine algebraically the number of hot dogs Cameron sold and the number of sodas he sold.  A customer has $20 to spend at the concession stand.  Determine and state the maximum number of hot dogs he can purchase if he buys four sodas.

## 0825AI
## Answer Section

1  ANS: 3          PTS: 2          REF: 082501ai     NAT: A.SSE.A.2
   TOP: Factoring the Difference of Perfect Squares
2  ANS: 3          PTS: 2          REF: 082502ai     NAT: A.CED.A.1
   TOP: Modeling Linear Equations
3  ANS: 2
   $g(-3) = -2(-3)^2 + 16 = -18 + 16 = -2$

   PTS: 2          REF: 082503ai     NAT: F.IF.A.2     TOP: Functional Notation
4  ANS: 2
   $x^2 - 8x - 20 = 0$

   $(x - 10)(x + 2) = 0$

   $x = 10, -2$

   PTS: 2          REF: 082504ai     NAT: A.APR.B.3    TOP: Zeros of Polynomials
5  ANS: 1
   $3(-2)^2 - \dfrac{1}{4}(-2) + 3 = 12 + \dfrac{1}{2} + 3 = 15.5$

   PTS: 2          REF: 082505ai     NAT: A.REI.D.10   TOP: Identifying Solutions
6  ANS: 3
   $x^2 = 8x - 15$

   $x^2 - 8x + 15 = 0$

   $(x - 3)(x - 5) = 0$

   $x = 3, 5$

   PTS: 2          REF: 082506ai     NAT: A.REI.D.11   TOP: Quadratic-Linear Systems
7  ANS: 4          PTS: 2          REF: 082507ai     NAT: A.SSE.A.1
   TOP: Modeling Expressions
8  ANS: 4          PTS: 2          REF: 082508ai     NAT: A.REI.A.1
   TOP: Identifying Properties
9  ANS: 4
   $f(x) = (x - 1)^2 - 3$; $g(x) = |x + 1|$; $h(x) = -4(2)^x$; $j(x) = 4x + 1$

   PTS: 2          REF: 082509ai     NAT: F.LE.A.1     TOP: Families of Functions

10  ANS:  2

$3x^2 - 24x = 0$

$3x(x - 8) = 0$

$x = 0, 8$

PTS:  2          REF:  082510ai      NAT:  A.REI.B.4      TOP:  Solving Quadratics
KEY:  factoring

11  ANS:  2

$\dfrac{2.5 - 10}{3 - 1} = \dfrac{-7.5}{2} = -3.75$

PTS:  2          REF:  082511ai      NAT:  F.IF.B.6      TOP:  Rate of Change

12  ANS:  1          PTS:  2          REF:  082512ai      NAT:  S.ID.C.8
TOP:  Correlation Coefficient

13  ANS:  4          PTS:  2          REF:  082513ai      NAT:  F.BF.B.3
TOP:  Transformations with Functions

14  ANS:  2

mean: $\dfrac{0 + 4 + 12 + 12 + 12 + 10}{20} = \dfrac{50}{20} = 2.5$, mode: 2, median: $\dfrac{2 + 2}{2} = 2$

PTS:  2          REF:  082514ai      NAT:  S.ID.A.1      TOP:  Dot Plots

15  ANS:  1          PTS:  2          REF:  082515ai      NAT:  F.IF.A.2
TOP:  Domain and Range

16  ANS:  3          PTS:  2          REF:  082516ai      NAT:  A.APR.A.1
TOP:  Powers of Powers

17  ANS:  1

$2A = h(b_1 + b_2)$

$\dfrac{2A}{b_1 + b_2} = h$

PTS:  2          REF:  082517ai      NAT:  A.CED.A.4    TOP:  Transforming Formulas

18  ANS:  1

$f(0) = 5, g(0) = 5, h(0) = -3$

PTS:  2          REF:  082518ai      NAT:  F.IF.C.9      TOP:  Comparing Functions

19  ANS:  3

$(x + 7)^2 + (x - 3)^2 = x^2 + 14x + 49 + x^2 - 6x + 9 = 2x^2 + 8x + 58$

PTS:  2          REF:  082519ai      NAT:  A.APR.A.1    TOP:  Operations with Polynomials
KEY:  multiplication

20  ANS:  1

$2\sqrt{10} \cdot 3\sqrt{2} = 6\sqrt{20} = 6\sqrt{4}\sqrt{5} = 12\sqrt{5}$

PTS:  2          REF:  082520ai      NAT:  N.RN.B.3      TOP:  Operations with Radicals
KEY:  multiplication

21 ANS: 3      PTS: 2      REF: 082521ai      NAT: A.APR.A.1
     TOP: Operations with Polynomials      KEY: subtraction

22 ANS: 4      PTS: 2      REF: 082522ai      NAT: F.IF.A.1
     TOP: Defining Functions

23 ANS: 1      PTS: 2      REF: 082523ai      NAT: A.REI.C.6
     TOP: Solving Linear Systems

24 ANS: 4      PTS: 2      REF: 082524ai      NAT: N.Q.A.1
     TOP: Conversions
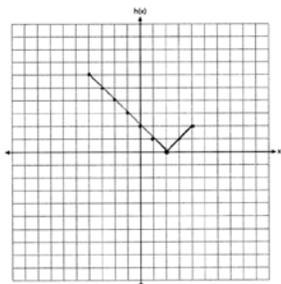
25 ANS:

$$\frac{1}{6}(4x + 12) = 9$$

$$4x + 12 = 54$$

$$4x = 42$$

$$x = 10.5$$

     PTS: 2      REF: 082525ai      NAT: A.REI.B.3      TOP: Solving Linear Equations

26 ANS:

Irrational because the sum can not be written as the ratio of two integers.

     PTS: 2      REF: 082526ai      NAT: N.RN.B.3      TOP: Operations with Radicals
     KEY: classify

27 ANS:



     PTS: 2      REF: 082527ai      NAT: F.IF.C.7      TOP: Graphing Absolute Value Functions

28 ANS:

|  | Brand A | Brand B | Total |
|---|---|---|---|
| Adults | 40 | 59 | 99 |
| Teenagers | 32 | 49 | 81 |
| Total | 72 | 108 | 180 |

     PTS: 2      REF: 082528ai      NAT: S.ID.B.5      TOP: Frequency Tables
     KEY: two-way

29 ANS:

$$a_8 = 5(3)^{8-1} = 10935$$

     PTS: 2      REF: 082529AI      NAT: F.BF.A.1      TOP: Sequences
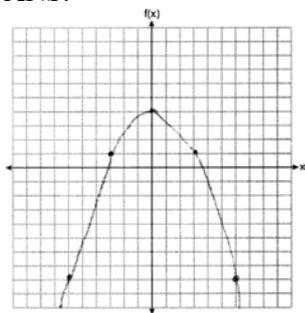
30 ANS:

$$x^2 + 14x = 28$$

$$x^2 + 14x + 49 = 28 + 49$$

$$(x + 7)^2 = 77$$

PTS: 2 REF: 082530ai NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: completing the square

31 ANS:



$(0,4), x = 0$

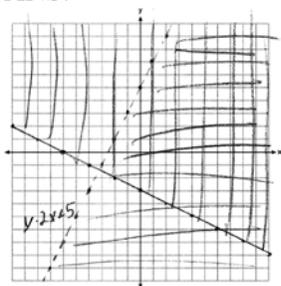PTS: 2 REF: 082531sai NAT: F.IF.C.7 TOP: Graphing Quadratic Functions

32 ANS:

$7.5x + 18 \le 78$ 9 hours

$$7.5x \le 60$$

$$x \le 8$$

PTS: 2 REF: 082532ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

33 ANS:



$(0,0)$ $0 \ge -\dfrac{1}{2}(0) - 3$ $y - 2x < 5$

$0 \ge -3$ $0 - 2(0) < 5$

$0 < 5$

PTS: 4 REF: 082533ai NAT: A.REI.D.12 TOP: Graphing Systems of Linear Inequalities

34 ANS:

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(3)}}{2(1)} = \frac{6 \pm \sqrt{24}}{2} = \frac{6 \pm 2\sqrt{6}}{2}$$

PTS: 4        REF: 082534ai        NAT: A.REI.B.4        TOP: Solving Quadratics
KEY: quadratic formula

35 ANS:

$x + y = 25$                  $y = 25 - x$   $y = 25 - 10 = 15$   $2.25x + 1.5(4) \le 20$   6 hot dogs

$2.25x + 1.5y = 45$   $2.25x + 1.5(25 - x) = 45$                  $2.25x + 6 \le 20$

$2.25x + 37.5 - 1.5x = 45$                  $2.25x \le 14$

$.75x = 7.5$                  $x \le 6.\overline{2}$

$x = 10$

PTS: 6        REF: 082535ai        NAT: A.CED.A.3        TOP: Modeling Linear Systems