1

If $42 = 3(x - 4)$, what is the value of x?
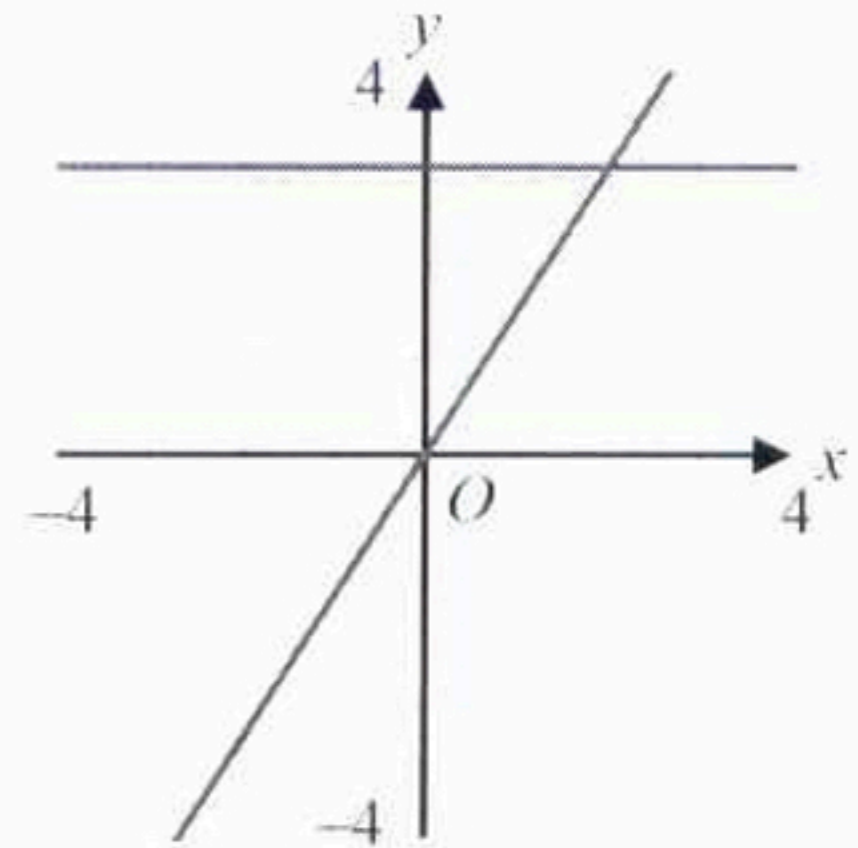
A) 4

B) 10

C) 18

D) 20

2

For what value of k does $x^2 + kx + 9 = (x + 3)^2$?

A) 0

B) 3

C) 6

D) 9

3

If (x, y) is the solution to the system of equations graphed above, what is the value of x in terms of y?

A) y

B) $\dfrac{2}{3}y$

C) $\dfrac{1}{3}y$

D) $-\dfrac{1}{3}y$

4

A barrel of crude oil is extracted from shale at a cost of $51, and then transported to and from the refinery at a cost of $6 each direction. Oil is processed three times at the refinery plant, at a cost of $9 each time. What is the profit, in dollars per barrel, if one barrel is sold for $93? (Profit is equal to revenue minus expenses.)

A) 1

B) 2

C) 3

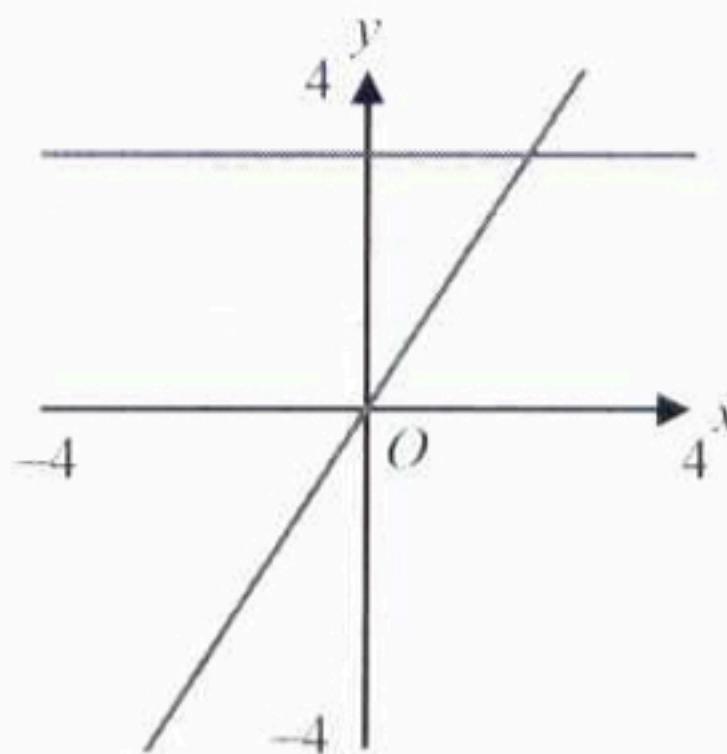D) 4

1

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A) 1

B) 2

C) 3

D) 4

5

If $c - 1 = 3$, what is the value of $c^2 - 1$?
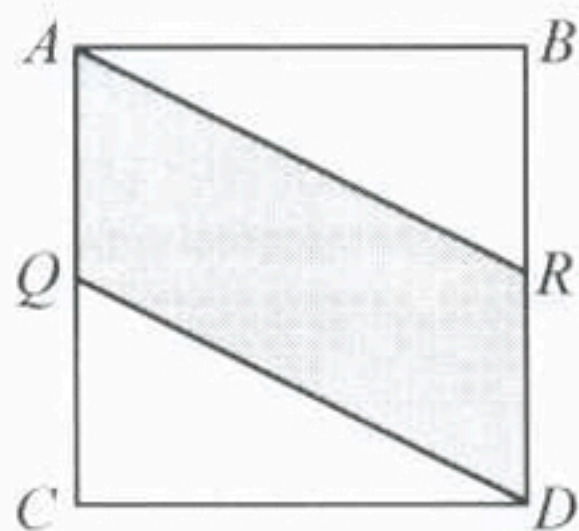
A) 3

B) 8

C) 10

D) 15

6

The square above has an area of 100. If Q is the midpoint of $\overline{AC}$ and R is the midpoint of $\overline{BD}$, what is the area of the shaded area?

A) 40

B) 50

C) 60

D) 75

7

If $2(3a - b) = 4b$ and $b = 6$, what is the value of a?

A) 6

B) −6

C) 2

D) 5

8

$$\frac{2x}{x - 1} - \frac{3x}{x + 1}$$

Which of the following expressions is equivalent to the expression above?

A) $-\dfrac{x}{x^2 - 1}$

B) $\dfrac{5x - x^2}{x^2 - 1}$

C) $-\dfrac{x}{x - 1}$

D) $-\dfrac{6x}{x^2 - 1}$

9

Joel is a years older than Luca. In b years, Joel will be twice as old as Luca. What is Joel's present age, in terms of a and b?

A) $-2(a-b)$

B) $-2a-b$

C) $2a-b$

D) $a-b$

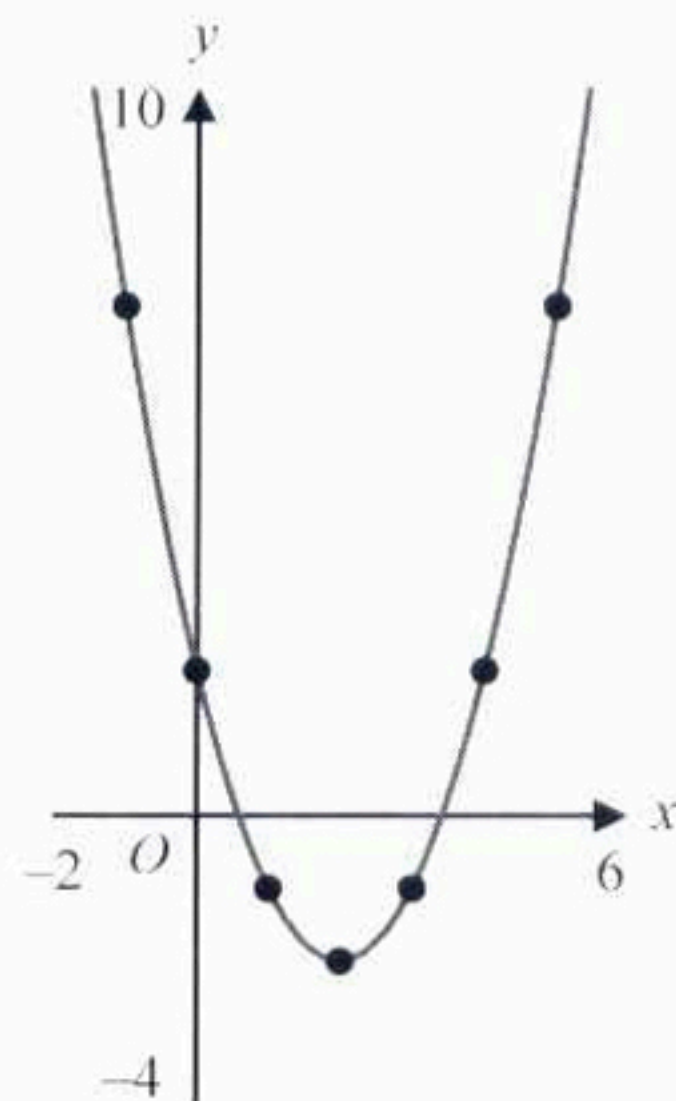**10**

$$|x-3| \leq 5$$

Which of the following inequalities is equivalent to the absolute value inequality above?

A) $-2 \leq x \leq 8$

B) $-8 \leq x \leq 2$

C) $x \leq -2$ or $x \geq 8$

D) $x \leq -8$ or $x \geq 2$

11

The figure above shows the graph of a quadratic function f with a minimum point at $(2, -2)$. If $f(5) = n$, what is a possible value for n?

A) $f(-2)$

B) $f(-1)$

C) $f(0)$

D) $f(1)$

12

$$\frac{16^x}{4^a + 4^a + 4^a + 4^a} = \frac{1}{4}$$

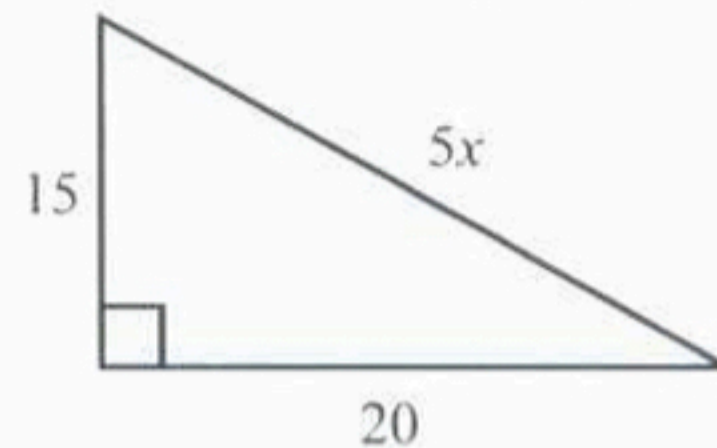Which equation best represents the value of x in terms of a?

A) $\dfrac{a}{4} = x$

B) $\dfrac{a}{2} = x$

C) $a = x$

D) $2a = x$

13

The sum of a and b is 132. If a is the square of b and the product of a and b is negative, what is a?

A) −12

B) 11

C) 121

D) 144

14

What is the value of x in the triangle above?

A) 5

B) 10

C) 25

D) 31

15

$$y = 5x^2 - 3x - 1$$
$$y + 6 = 7x$$

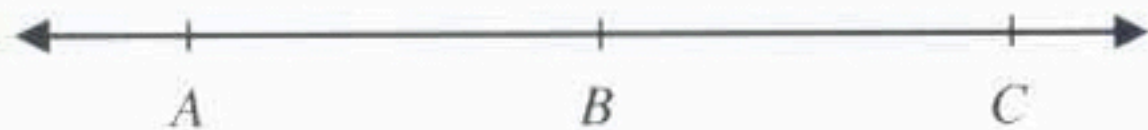In the system of equations above, what is the value of y in terms of x?

A) $-x$

B) x

C) $2x$

D) $3x$

16

A stone is dropped from a height of 9 meters above the ground. If the height function can be modelled by the equation $h(t) = a - t^2$, where t is time in seconds and h is height in meters, how many seconds does it take for the stone to hit the ground?

17

A, B and C lie on a line, as shown above. The length of $\overline{AB}$ is $x - 4$ and the length of $\overline{AC}$ is $x + 6$. What is the length of $\overline{BC}$?

18

If $f(x) = 8x + 1$ and $g(x) = 3x - 1$, what is the value of $\dfrac{f(2)}{g(f(0))}$?

19

$$\frac{d}{y} = \frac{12}{d}$$

$$y^2 = 6y - 9$$

If d is positive, what is the value of d in the series of equations above?

20

The imaginary number i is defined such that $i^2 = -1$. What is the value of $(1 - i\sqrt{5})(1 + i\sqrt{5})$?

1

If $y = x - 2$, and $x = 2y + 4$, what is the value of x?

A) 1

B) 0

C) –2

D) –6

2

x	0	2	4	6
$f(x)$	3	4	5	6

Which of the following expressions defines $f(x)$ in the table above?

A) $f(x) = x + 3$

B) $f(x) = \frac{1}{2}x + 3$

C) $f(x) = x$

D) $f(x) = 2x$

3

If a farmer in Kansas purchases 8 pigs for every 1.5 acres of land and has 6 acres of land set aside for pigs, how many pigs will she purchase?

A) 20

B) 32

C) 40

D) 48

4

$$\frac{x-1}{3} = \frac{2x-6}{4}$$

What is the value of x that satisfies the equation above?

A) 5

B) 7

C) 8

D) 16

5
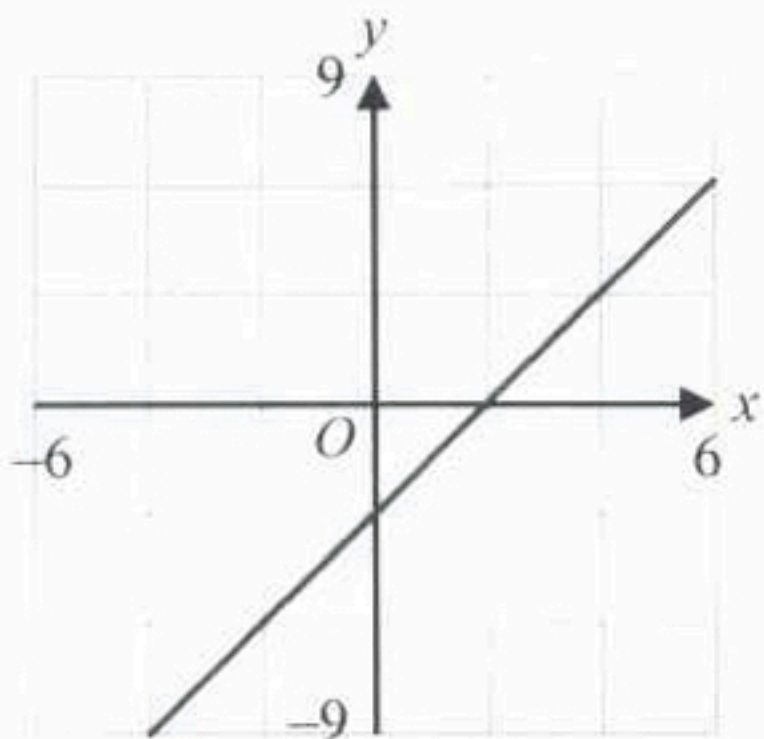
If $8x + 4 = 48$, what is $2x + 1$?

A) 9

B) 10

C) 11

D) 12

6

What is the slope of the function in the graph above?

A) 2

B) $\dfrac{3}{2}$

C) $\dfrac{2}{3}$

D) $\dfrac{1}{2}$

7

The population of an invasive species of moth doubles every 5 years. If the initial population is 300, what will be the population after 15 years?

A) 900

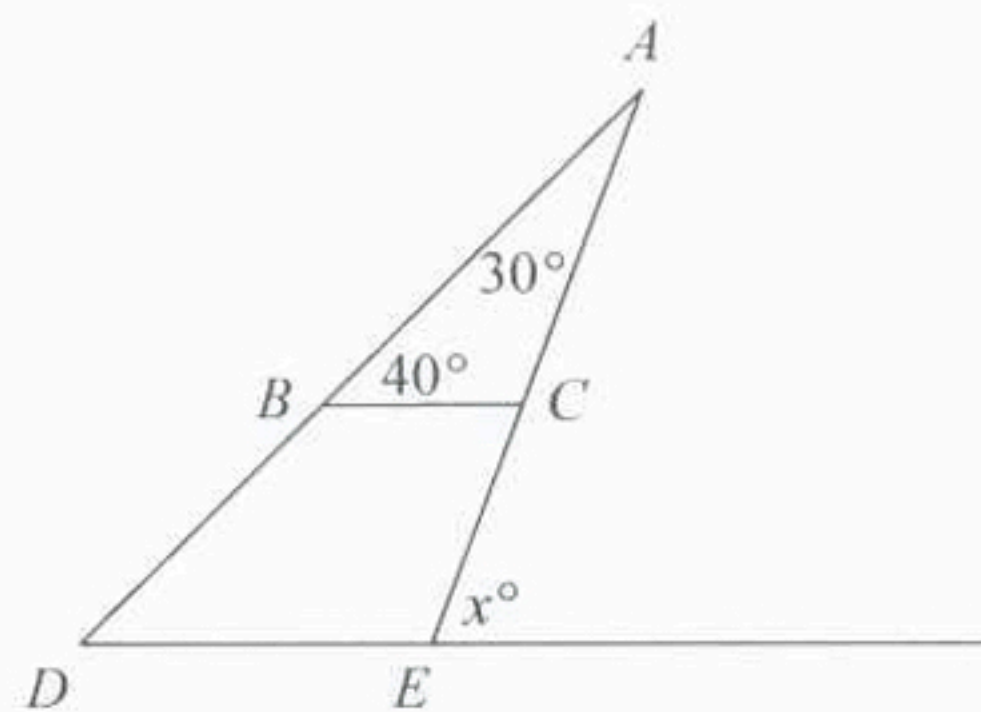B) 1200

C) 2000

D) 2400

8

John fills his bag with five cent candies, v, and ten cent candies, t. If he has a total of 54 candies and his candies are worth \$3.10, which of the following is true?

I. $\$0.05v + \$0.10t = \$3.10$

II. $54 = v + t$

III. $\$0.05 \times (54 - v) + \$0.10v = \$3.10$

A) I only

B) I and II only

C) I, II, and III

D) None of the above

9

In the figure above, if $\overline{BC} \parallel \overline{DE}$, what is the value of x?

A) 30

B) 40

C) 70

D) 110

10

Ali buys 10 burgers and 7 chocolate milkshakes for $50.95. If the price of a chocolate milkshake is $0.25 cheaper than the price of a burger, what is the price of a chocolate milkshake?

A) $2.85

B) $3.10

C) $4.05

D) $5.09

11

The acute angles of a right triangle have a ratio of 12 to 3. What is the difference between the two angle measures?

A) 42 degrees

B) 54 degrees

C) 64 degrees

D) 72 degrees

12

A number is a palindrome if it is the same written backwards and forwards (6336 is an example of a palindrome). What number divides into every 4 digit palindrome?

A) 2

B) 3

C) 7

D) 11

13

Day	Number of books
Monday	x
Tuesday	$2x$
Wednesday	$0.5x$
Thursday	x
Friday	$3.5x$

The above table outlines how many books Anthony reads per day in terms of x. What is the average daily number of books that Anthony reads, in terms of x?

A) $\dfrac{5x}{8}$

B) x

C) $\dfrac{8x}{5}$
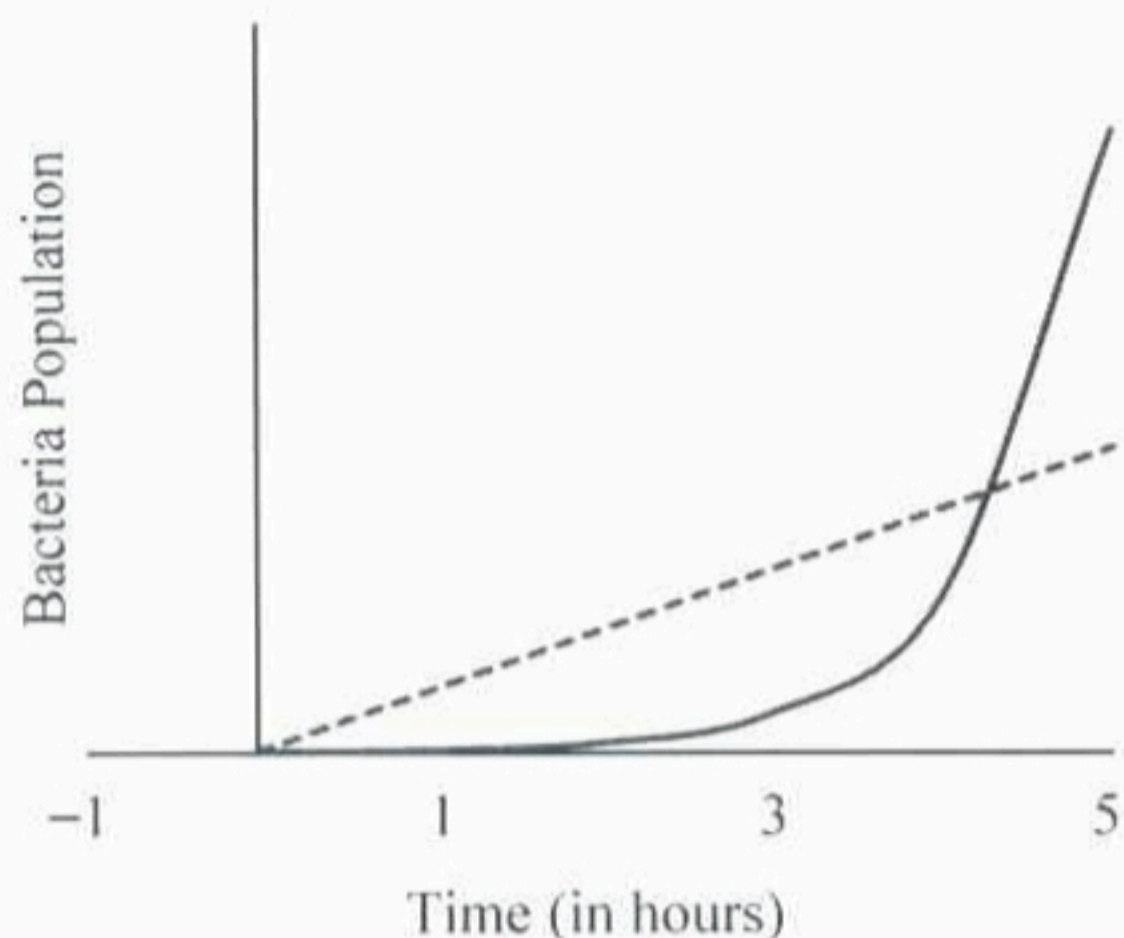
D) $8x$

14

$$x^2 - 1 < x^3$$

For which of the following values is the above inequality true?

A) $x = -3$

B) $x = -2$

C) $x = -1$

D) $x = 0$

15

Growth of Bacteria Populations

Bacteria A is represented by the solid line and Bacteria B is represented by the dotted line in the graph shown above. Which of the following statements is TRUE?

A) Bacteria A is growing at a linear rate.

B) Bacteria B is growing at an exponential rate.

C) Neither Bacteria A nor Bacteria B is growing at a linear rate.

D) Bacteria B is growing linearly, but Bacteria A is growing exponentially.

16

Which of the following values of x results in the largest value of y in the equation $y = -(x-2)^2 + 4$?

A) –2

B) 0

C) 2

D) 4

17

$$x = 12$$
$$3x = 4y^2$$

In the system of equations above, if $y > 0$, what is the value of $x^2 y$?
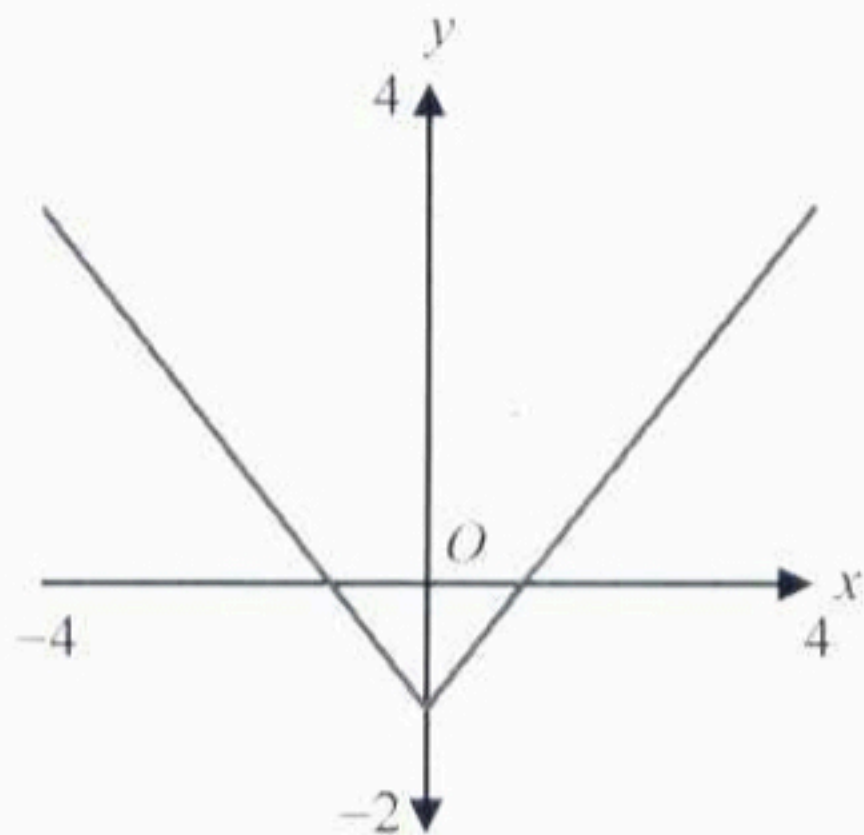
A) 36

B) 108

C) 432

D) 1296

18

The product of two positive consecutive even numbers is 168. What is the smaller of the two numbers?

A) 24

B) 21

C) 14

D) 12

19

The function $f(x)$ is graphed above. If $g(x) = f(x) - 1$, which of the following statements is true?

A) $g(x)$ is greater than or equal to zero.

B) $g(x)$ is greater than or equal to negative one.

C) $g(x)$ is greater than or equal to negative two.

D) $g(x)$ is greater than negative one, but smaller than five.

20

Three different integers are randomly selected from a group of five unique integers consisting of 1 through 5. What is the probability that these numbers are 1, 2, and 3?

A) One in five

B) One in ten

C) One in twenty

D) One in sixty

21

The ratio of d:c is 3:1. If the sum of d and c is s, what is the value for d, in terms of s?

A) $\frac{4}{3}s$

B) $\frac{3}{4}s$

C) $s - 3$

D) $s - 4$

Questions 22 and 23 refer to the following information.

A survey on coffee consumption was conducted among a random sample of students at a university. A total of 200 students were surveyed. The table below displays a summary of the results.

Cups of Coffee (Per Day)				
Student Year	0	1	2 or more	Total
Freshman	25	9	16	50
Sophomore	5	19	26	50
Junior	10	6	50	66
Senior	0	2	32	34
Total	40	36	124	200

22

Based on the information in the table, who would be least likely to drink any cups of coffee during the day?

A) a freshman

B) a sophomore

C) a junior

D) a senior

23

Which of the following statements about the students surveyed is not supported by the table above?

A) A higher percentage of juniors than sophomores drink 2 or more cups of coffee per day.

B) A higher percentage of juniors than seniors drink 2 or more cups of coffee per day.

C) 20% of all students surveyed do not drink coffee.

D) 50% of the freshmen do not drink coffee.

24

Number of Passengers Using the
Commuter Line
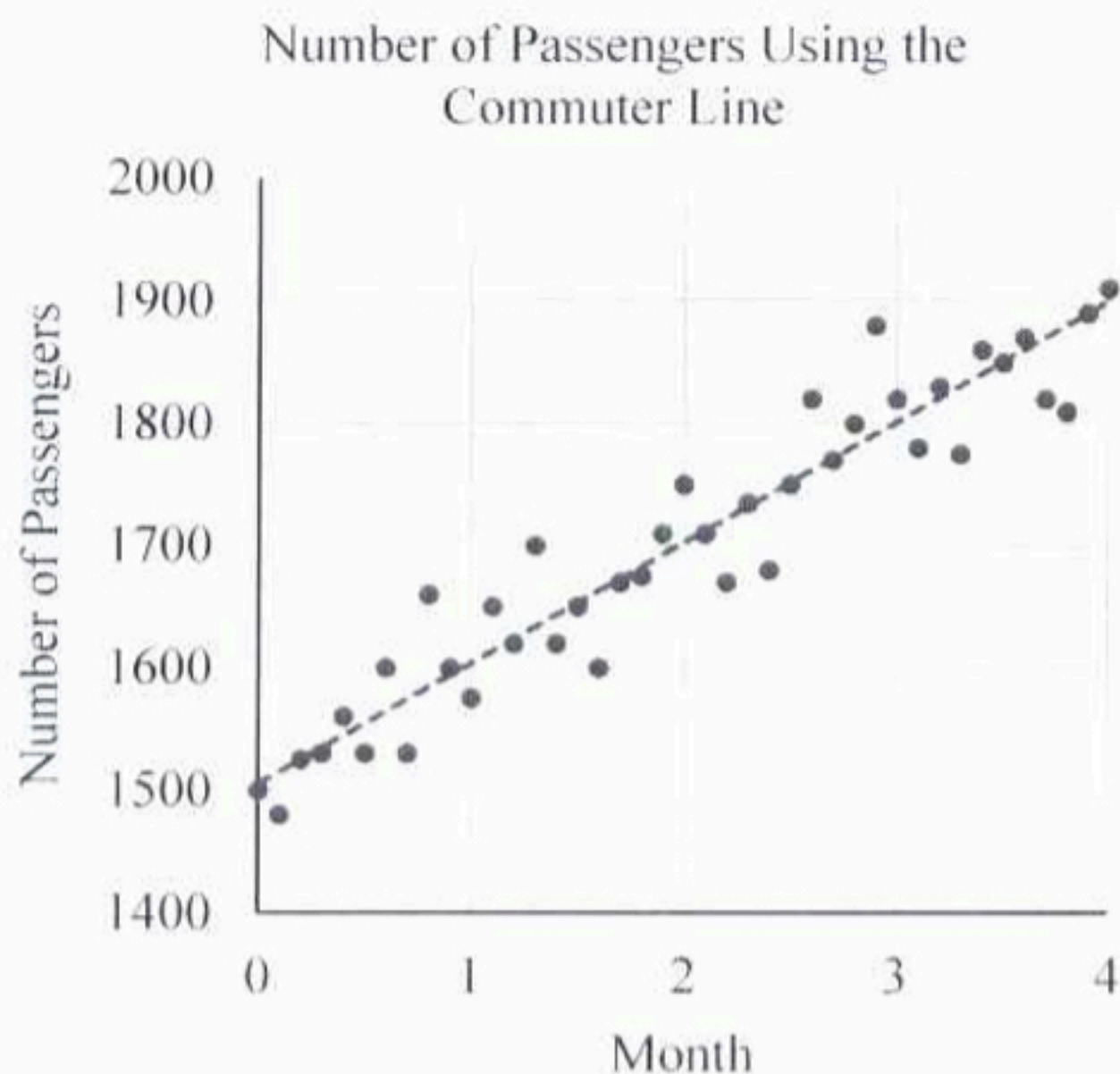
The graph above shows the number of passengers
on a train line over 4 months. If m is the number of
months, which of the following functions best
represents the graph's line of best fit?

A) $f(m) = 200 + 1500m$

B) $f(m) = 150 + 100m$

C) $f(m) = 1500 + 100m$

D) $f(m) = 150m + 1500$

25

Produce at the Farmer's Market	
Fruit	Price
Apples	3 for 2 dollars
Peaches	1 for 1 dollar
Oranges	4 for 3 dollars

The chart above shows the prices for fruit at a
farmer's market. Claire spends 4 dollars on apples,
2 dollars on peaches, and 3 dollars on oranges and
puts all of her fruits in a brown bag. If she
randomly selects a fruit from her bag, what is the
probability she grabs an apple?

A) $\dfrac{1}{4}$

B) $\dfrac{1}{3}$

C) $\dfrac{1}{2}$

D) $\dfrac{2}{3}$

26

j is equal to 925 and k is equal to 5,550. A number,
n, is added to j, such that the ratio of $j + n$ to k is
1:3. What is the ratio of n to $j + n$, expressed as a
percentage of $j + n$?

A) 30%

B) 40%

C) 50%

D) 60%

27

When Amelia goes cliff diving in Bali, her height above the water can be modelled by the function $f(t) = -2t^2 + 4t + 30$, where t represents time in seconds. How long, in seconds, does it take for Amelia to hit the water?
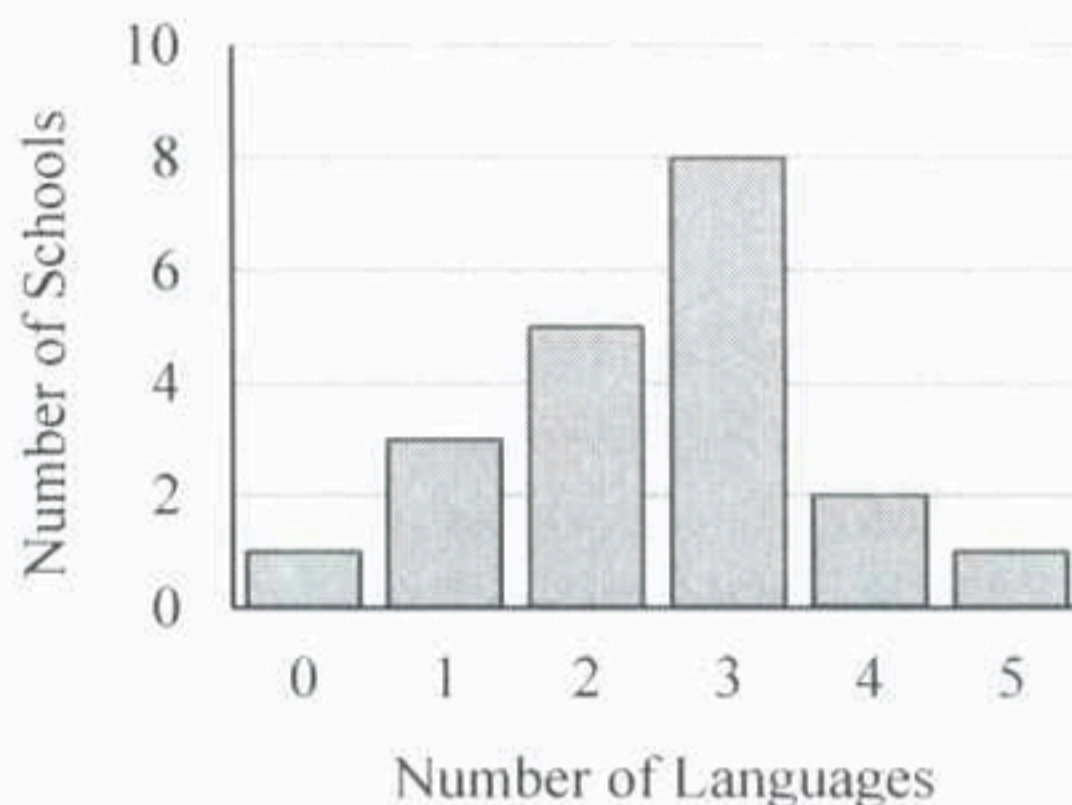
A) 3

B) 4

C) 5

D) 6

28

The average of 5 positive numbers is 85. If the highest of these numbers is 100, which of the following statements cannot be true?

A) The lowest score is 20.

B) The highest range possible is 75.

C) The median is greater than 25.

D) The mode is 85.

29

Number of Foreign Languages
Offered in a High School Curriculum

20 high schools were surveyed on the number of languages offered in their curriculum. The results are shown in the chart above. How many schools offer fewer languages than average across the 20 schools?

A) 9

B) 10

C) 11

D) 17

30

A city wants to replace 10% of its bus fleet with hydrogen-powered buses. Each hydrogen-powered bus costs $200,000. If there are 180 buses in the city, how much money, in dollars, will it cost for the city to meet its goal?

A) 1,800,000

B) 2,000,000

C) 3,600,000

D) 4,000,000

31

If $2x$ is equal to the sum of 11, 12, and 13, what is the value of x?

32

$$-15(2+n)=-16(n-7)$$
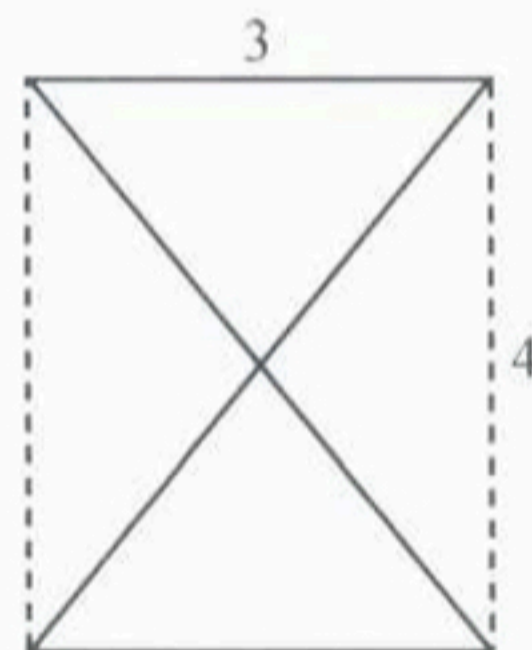
What is the value of n in the equation above?

33

If x is 60% of y, and y is 30% of z, x is what percent of z?

34

$$8^{3x-1} = \frac{1}{4^{3x-21}}$$

What is the value of x in the equation above?

35

A rectangle has side lengths 3 and 4 as shown in the figure above. What is the total length of the solid lines?

36

What is the radius of the circle with the equation $x^2 + y^2 - 7 = 9$?

Questions 37 and 38 refer to the following information.

Susan is training for a marathon. To track her progress, she has been keeping a record of her recent practice runs. The table below summarizes her training progress.

Time For Practice Runs		
Week	Distance (in miles)	Time (in minutes)
1	10	100
2	12	108
3	8	68
4	10	87
5	12	105

37

How much faster, in seconds, did Susan run each mile in Week 3 compared to Week 4?

38

Susan would like to run 26 miles in 3 hours and 54 minutes. Currently, she can run 26 miles at a pace of 11 minutes/mile. If she plans on improving her pace by 15 seconds/mile every week, how many weeks will it take Susan to reach her goal?