

1

If $x - 2y = 10$, $y = z + 1$, and $z = 2$, what is the value of x ?

- A) 12
- B) 14
- C) 16
- D) 18

2

$$\begin{aligned} 2x + 6y &= 5 \\ ax + by &= 7 \end{aligned}$$

If the system of equations above has only one solution, which of the following could be the values of a and b ?

- A) $a = 1$ and $b = 3$
- B) $a = 2$ and $b = 6$
- C) $a = 3$ and $b = 8$
- D) $a = 4$ and $b = 12$

3

A smart phone company plans to produce and sell p smart phones. The cost of producing p phones is given by $265,000 + 150p$ in dollars. The company receives \$400 on the sale of each phone, so the revenue for selling p phones is given by $400p$. For what value of p is the revenue equal to the cost?

- A) 500
- B) 840
- C) 1060
- D) 1200

4

$$\left(a + \frac{1}{a}\right)^2 - 2$$

Which of the following is equivalent to the expression above?

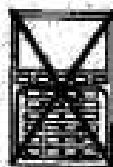
- A) $a^2 + \frac{1}{a^2}$
- B) $a^2 + \frac{1}{a^2} - 2$
- C) $a^2 - 2a + \frac{1}{a^2}$
- D) $a^2 + 2 + \frac{1}{a^2}$

5

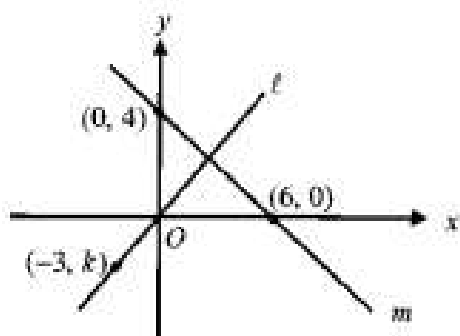
$$\sqrt{a^2 - a + 4} = 2$$

If a is a positive number in the equation above, what is the value of a ?

- A) 10
- B) 8
- C) 4
- D) 1



6



In the xy -plane above, line l is perpendicular to line m . What is the value of k ?

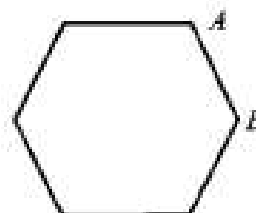
- A) -1
- B) -2
- C) -3
- D) -4.5

7

If $4a = 2b = c$, what is the average (arithmetic mean) of a , b , and c in terms of a ?

- A) $\frac{4a}{3}$
- B) $2a$
- C) $\frac{7a}{3}$
- D) $3a$

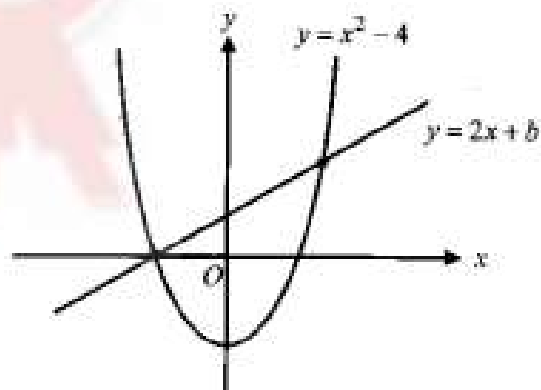
8



The figure above shows a regular hexagon. If the length of \overline{AB} is 4, what is the area of the hexagon?

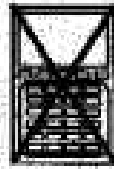
- A) 24
- B) $24\sqrt{3}$
- C) 32
- D) $32\sqrt{3}$

9



In the xy -plane above, two graphs intersect at two points. What is the value of b ?

- A) 1
- B) 2
- C) 3
- D) 4



10

$$\frac{1}{2} \left(\frac{1}{x-1} - \frac{1}{x+1} \right)$$

Which of the following is equivalent to the expression above?

- A) $\frac{1}{2} \left(\frac{1}{x^2-1} \right)$
 B) $\frac{1}{x^2-1}$
 C) $\frac{-2}{x^2-1}$
 D) $\frac{-2x}{x^2-1}$

11

The surface area S of a cylinder with radius r and height h is $S = 2\pi r^2 + 2\pi rh$. If the surface area of the cylinder is 20π and the height is 3, what is the value of r ?

- A) 1
 B) 2
 C) 4
 D) 5

12

$$R = \frac{(m_1 + m_2)}{m_1}$$

The ratio for the kinetic energy between two objects of mass m_1 and m_2 before and after the collision is given above. Which of the following is equivalent to the expression for m_1 ?

- A) $\frac{m_2}{R}$
 B) $\frac{R-1}{m_2}$
 C) $\frac{m_2}{R-1}$
 D) $\frac{m_2 - R}{R}$

13

$$f(x) = x^2 + ax - 10$$

If $f(2) = 0$ in the quadratic function above, which of the following must be true?

- A) $f(-5) = 0$
 B) $f(-2) = 0$
 C) $f(-1) = 0$
 D) $f(0) = 0$



14

$$2a + (4a + 2)i = b - 10i$$

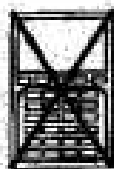
If $i = \sqrt{-1}$ in the equation above, where a and b are constants, what is the value of b ?

- A) 6
- B) 4
- C) -3
- D) -6

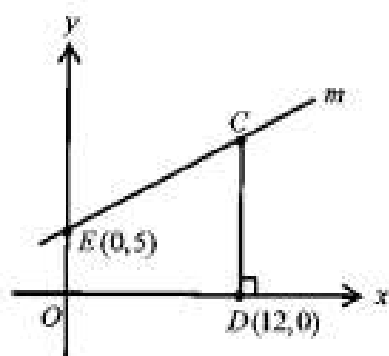
15

Esposito tried to compute the average of his 10 math scores. He mistakenly divided the correct total S of his scores by 8. The result was 5 more than what it should have been. Which of the following would determine the value of S ?

- A) $10S = 7S + 5$
- B) $\frac{S}{10} = \frac{S}{8} + 5$
- C) $\frac{S}{8} - \frac{S}{10} = 5$
- D) $\frac{S + 5}{10} = \frac{S}{8}$



16



If the slope of line m in the xy -plane above is $\frac{1}{3}$, what is the area of quadrilateral $OEC D$?

17

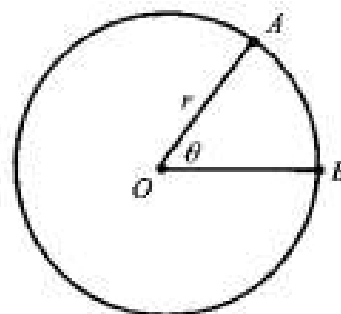
Claire and Peter both want to buy new smart phones. Claire has already saved 100 dollars and plans to save 5 dollars per week until she can buy the phone. Peter has 25 dollars and plans to save 8 dollars per week. In how many weeks will Claire and Peter have saved the same amount of money?

18

$$(a - 8)x^2 + (b - 5)x + c + 2 = 0$$

In the equation above, a , b , and c are constants. If the equation is true for all values of x , what is the value of $a + b + c$?

19



In the figure above, O is the center of the circle with radius r , and the measure of θ is $\frac{\pi}{5}$ radians. If the length of minor arc AB is 3π , what is the value of r ?

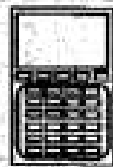
20

In a certain class of 70 students, $\frac{4}{7}$ of the students are boys, and the ratio of students 10 years or older to students less than 10 years is 2:3. If $\frac{2}{3}$ of the girls are less than 10 years old, how many boys are 10 years old or older?

STOP

If you finish before time is called, you may check your work on this section only.

Do not turn to any other section in the test.



1

During its Labor Day sale, a store advertises that \$40 will be deducted from every purchase over \$200. In addition, after the deduction is taken, the store offers an early-bird discount of 40% to any person who makes a purchase before 9 a.m. If Claire makes a purchase of k dollars, $k > 200$, at 8 a.m., which of the following expressions represents the cost of her purchase?

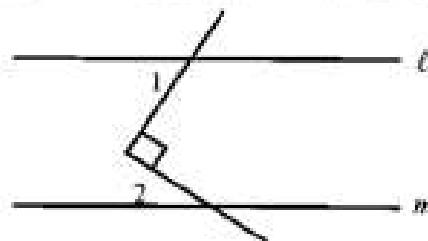
- A) $0.4k - 16$
- B) $0.4k - 24$
- C) $0.6k - 24$
- D) $0.6k - 40$

2

On a map, 3 centimeters represents k kilometers. How many kilometers are represented by p centimeters?

- A) $3pk$
- B) $\frac{k}{3p}$
- C) $\frac{3k}{p}$
- D) $\frac{pk}{3}$

3



In the figure above, lines l and m are parallel. If the measure of $\angle 1$ is 20° more than the measure of $\angle 2$, what is the measure of $\angle 1$?

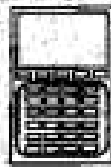
- A) 35°
- B) 45°
- C) 55°
- D) 75°

4

$$T = 150 + 20w$$

Cassy plans to buy a new computer, and plans to save \$20 each week for the next w weeks. The total amount of money she saved is represented by the equation above, where T is the total amount. Which of the following is the best interpretation of the number 150 in the equation?

- A) The new computer costs \$150.
- B) She saved \$150 each week.
- C) She wants to buy a computer when she saves \$150.
- D) She has already saved \$150 toward the cost of a new computer.



Questions 5 and 6 refer to the following information.

Dog age (D)	0	2	4	6	8	...	15
Human age (H)	a	10	20	30	40	...	b

The chart above shows equivalent ages for dogs and humans. Human age is directly proportional to dog age.

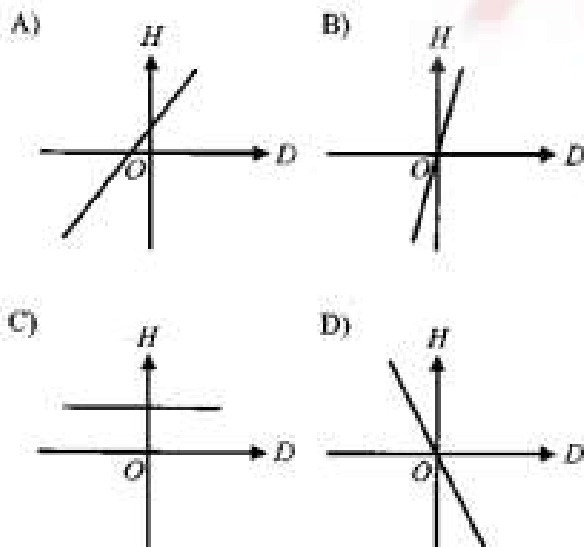
5

What is the value of $a + b$?

- A) 60
- B) 75
- C) 80
- D) 85

6

Which of the following graphs best represents the relationship between dog and human ages?



7

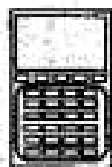
In the fraction $\frac{a-5}{2b}$, a is 5 less than two times b . If the fraction is equal to $\frac{1}{2}$, what is the value of a ?

- A) 15
- B) 20
- C) 25
- D) 30

8

Tyler spent 60 dollars at an amusement park for admission and rides. If he paid \$10 for admission, and rides cost \$3 each, what is the maximum number of rides that he went on?

- A) 16
- B) 17
- C) 18
- D) 20



9

For a school summer concert, one type of ticket costs \$5 and another costs \$10. The supervisor of the concert can sell at most 500 tickets, but the gross receipts must total at least \$3,000 in order for the concert to be held. Which of the following systems of inequalities could represent this relationship?

A)
$$\begin{cases} 5x + 10y \geq 3000 \\ x + y \leq 500 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

B)
$$\begin{cases} \frac{5}{x} + \frac{10}{y} \leq 500 \\ x + y \leq 3000 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

C)
$$\begin{cases} 5x + 10y \leq 3000 \\ x + y \leq 500 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

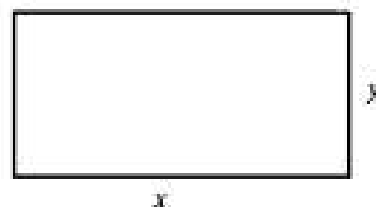
D)
$$\begin{cases} 5x + 10y > 3000 \\ x + y < 500 \\ x > 0 \\ y > 0 \end{cases}$$

10

If a linear function f satisfies $f(3) = 10$ and $f(7) = 18$, what is the value of $f(5)$?

- A) 12
- B) 14
- C) 15
- D) 16

Questions 11 and 12 refer to the following information.



A rancher has 100 feet of fencing to enclose rectangular region as shown above. The length and width are represented by x and y respectively.

11

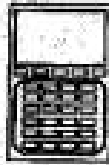
Which of the following expressions represents the area of the rectangular region as a function of x ?

- A) $100x - x^2$
- B) $50x - x^2$
- C) $50x + x^2$
- D) $50x^2$

12

If the value of y is 25, what is the area of the rectangular region in square feet?

- A) 325
- B) 625
- C) 1250
- D) 2500



13

Factory Workers over 60		
Year	Percent of Men	Percent of Women
1990	19.6	13.5
2000	23.6	10.8

The table above shows the percent of men and women 60 years and older who were working in a certain factory in the U.S. in the given years. If the rate of increase or decrease every year is constant, which of the following represents the percent of men over 60 who were working in the factory in the year 2015?

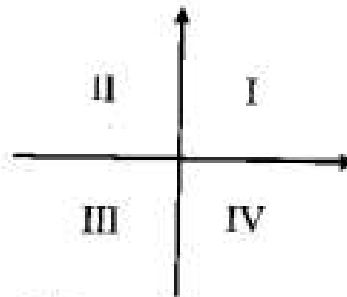
- A) 26.6
- B) 27.2
- C) 29.6
- D) 30.5

14

Mary is making a rectangle whose perimeter is less than 100 inches. If the dimensions of the rectangle are integers, what is the largest possible area for the rectangle in square inches?

- A) 600
- B) 625
- C) 650
- D) 800

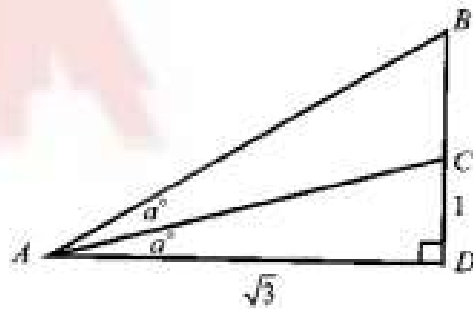
15



If $z = 3 + 2i$ is in the first quadrant of the complex number plane above, then which quadrant contains z^2 ?

- A) Quadrant I
- B) Quadrant II
- C) Quadrant III
- D) Quadrant IV

16

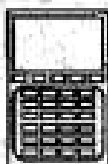


In the figure above, $AD = \sqrt{3}$ and $CD = 1$. What is the length of \overline{AB} ?

- A) 2
- B) 3
- C) $2\sqrt{3}$
- D) $3\sqrt{3}$

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CONTINUE

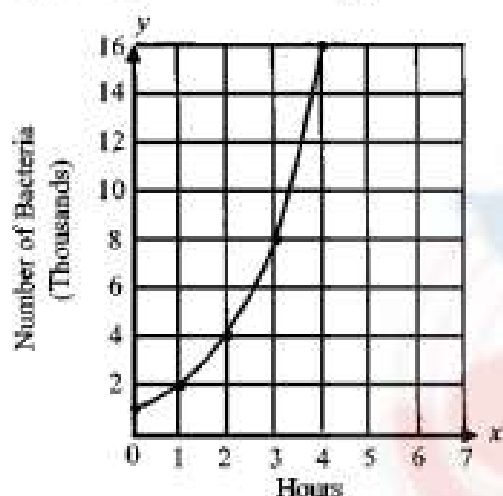


Questions 17 and 18 refer to the following information.

The number of bacteria in a controlled laboratory environment is defined by the function

$f(x) = 1000 \times b^x$, where x is the time in hours.

The graph of f is shown in the xy -plane below.



17

What is the value of b ?

- A) 1
- B) 2
- C) 3
- D) 4

18

What is the number of bacteria in 5 hours?

- A) 27,000
- B) 32,000
- C) 40,000
- D) 64,000

19

A school nurse chose 50 girls from the seventh grade and measured their weight, in pounds, shown in the table below.

Measure of Weight	Frequency
70	5
75	8
78	20
80	10
85	5
90	2

If there is a total of 500 girls in the seventh grade, what could be the possible number of girls in the median measure of weight for the entire grade?

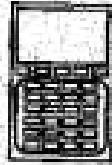
- A) 80
- B) 100
- C) 150
- D) 200

20

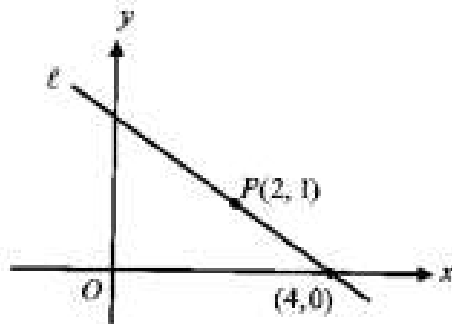
$$x^2 - 2x + y^2 = 10$$

The equation of a circle in the xy -plane is shown above. What is the center of the circle?

- A) (1, -1)
- B) (1, 1)
- C) (1, 0)
- D) (2, 0)



21



The graph of line ℓ is shown in the xy -plane above. Line m (not shown) has the equation $y = ax + b$, where a and b are constants. If line m is perpendicular to line ℓ and passes through point P , what is the value of b ?

- A) 0
- B) -1
- C) -2
- D) -3

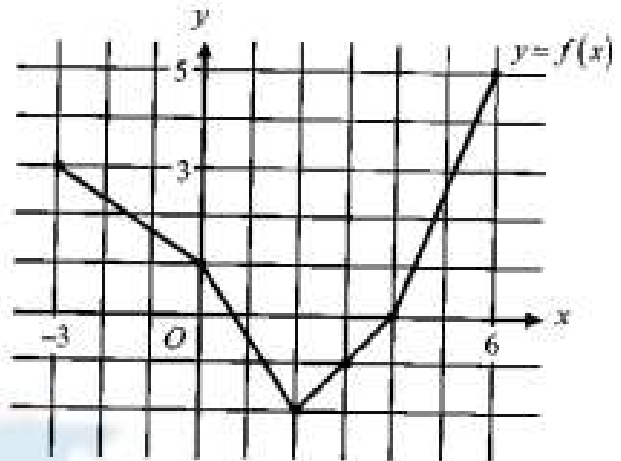
22

$$2^{3k-1} = 64$$

In the equation above, what is the value of 2^k ?

- A) 4
- B) 8
- C) 16
- D) 32

23



The complete graph of the function f is shown in the xy -plane above. Which of the following is true?

- A) $f(0) > |f(0)|$
- B) $f(2.2) < |f(2.2)|$
- C) $f(3) > |f(3)|$
- D) $f(-2) < |f(-2)|$

24

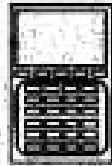
$$y = -\frac{1}{10}x^2 + k$$

$$y = 5$$

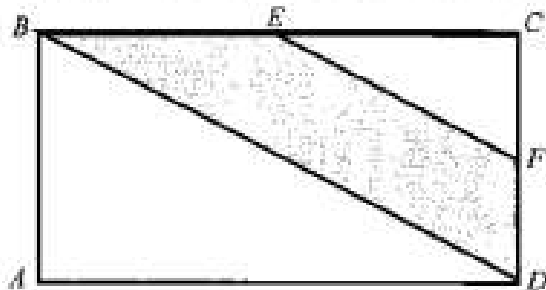
In the system of equations above, k is a constant. For which of the following values of k does the system of equations have no real solution?

- A) 10
- B) 8.5
- C) 5
- D) -0.05

36/215



25



In the figure above, E and F are the mid points of two sides of a rectangle. If the area of $\triangle CEF$ is 10, what is the area of the shaded region?

- A) 15
- B) 20
- C) 25
- D) 30

26

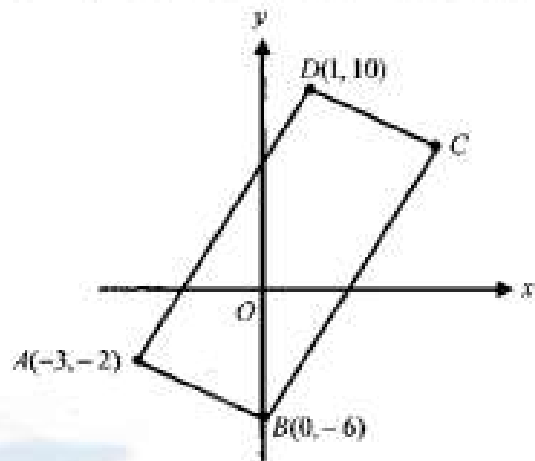
$$x - y = 5$$

$$xy = 10$$

In the equations above, what is the value of $x^2 + y^2$?

- A) 15
- B) 25
- C) 36
- D) 45

27



In the xy -plane above, the figure shows the coordinates of points A , B , and C of a parallelogram. Which of the following are the coordinates of point C ?

- A) (3, 5)
- B) (4, 6)
- C) (5, 5)
- D) (6, 5)

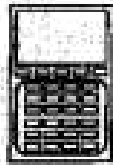
28

$$a^2 + b^2 \leq 25$$

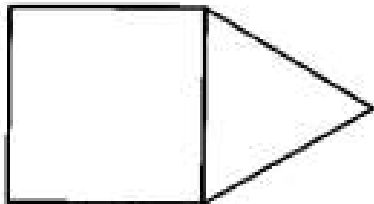
$$b \geq 3$$

In the inequalities above, what is the greatest possible value of a ?

- A) -4
- B) -3
- C) 3
- D) 4



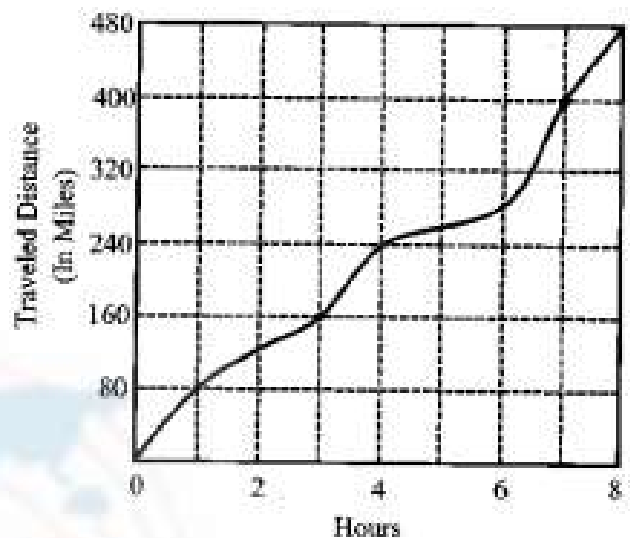
29



The figure above shows a square and an equilateral triangle. If the area of the triangle is $25\sqrt{3}$ square inches, what is the area, in square inches, of the square?

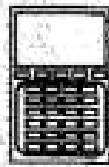
- A) $50\sqrt{3}$
- B) 100
- C) $100\sqrt{3}$
- D) 125

30



The graph above compares the distance with the number of hours that a car traveled. Which of the following is the average speed, in miles per hour, of the car during the time between 3 and 7 hours?

- A) 50
- B) 55
- C) 60
- D) It cannot be determined from the given information.



DIRECTIONS

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If $\frac{31}{2}$ is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Grid in result. →

Answer: $\frac{7}{12}$

7	/	1	2
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

← Fraction line

Answer: 2.5

2	.	5
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

← Decimal point

Acceptable ways to grid $\frac{2}{3}$ are:

2	/	3
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

.	6	6	6
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

.	6	6	7
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

Answer: 201

Either position is correct.

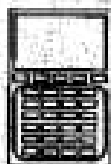
2	0	1
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

2	0	1
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○
○	○	○

Note: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

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CONTINUE



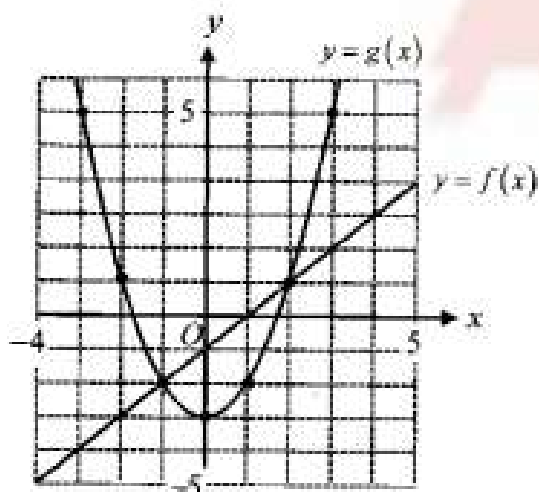
31

Jackie goes on a 30-mile bike ride every Sunday. He rides the distance in 3 hours. At this rate, how many miles can he ride in 5 hour and 30 minutes?

32

The average of a set of 8 consecutive odd integers is 18. What is the greatest of these 8 integers?

33



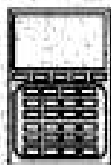
The graphs of a linear function f and a quadratic function g are shown in the xy -plane above. If $f(g(k)) = -3$, what is the value of $|k|$?

34

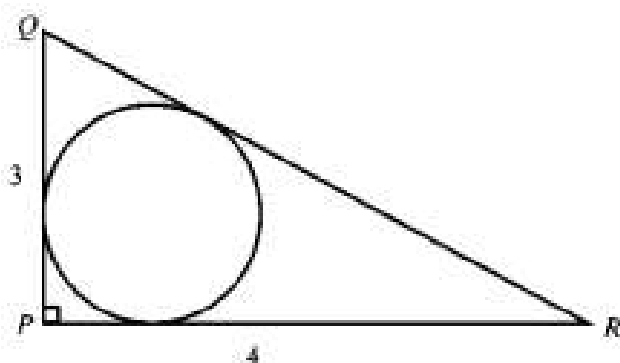
In the xy -plane, line $x = 2$ is the axis of symmetry of the graph of $f(x) = 5x^2 - kx + 2$. What is the value of k ?

35

Twenty grams of solution P is 10% alcohol and 30 grams of solution Q is 20% alcohol by mass. If these two solutions are mixed together, what is the percent of alcohol in the mixture? (Disregard the % sign when gridding your answer.)



36



In the figure above, a circle is inscribed in $\triangle PQR$. If $PQ = 3$ and $PR = 4$, what is the radius of the circle?

Questions 37 and 38 refer to the following information.

The total cost of an internet phone-call is the sum of

- (1) a basic fixed charge for using the internet and
- (2) an additional charge for each minute that is used.

The total cost of a 20 minute-call is \$24 and the total cost of a 35 minute-call is \$31.50.

(Disregard the \$ sign when gridding your answer.)

37

What is the basic fixed charge, in dollars, for using the internet?

38

What is the total cost, in dollars, of a 40 minute-call?

STOP

If you finish before time is called, you may check your work on this section only.
Do not turn to any other section in the test.