



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

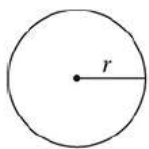
DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

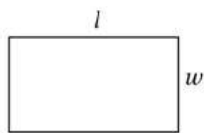
1. The use of a calculator is NOT permitted.
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3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function f is the set of all real numbers for which $f(x)$ is a real number.

REFERENCE

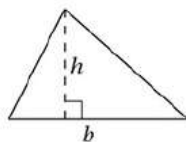


$$A = \pi r^2$$

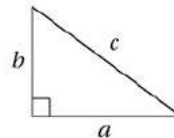
$$C = 2\pi r$$



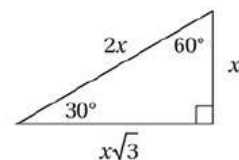
$$A = lw$$



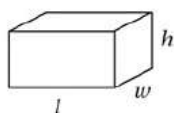
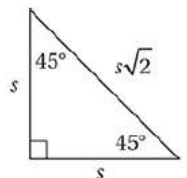
$$A = \frac{1}{2}bh$$



$$c^2 = a^2 + b^2$$



Special Right Triangles



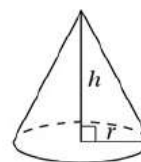
$$V = lwh$$



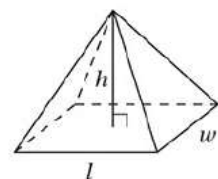
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

1

If $8x + 6 = 6m$, what is the value of $4x + 3$ in terms of m ?

- A) $2m - 3$
- B) $2m$
- C) $3m - 3$
- D) $3m$

2

$$3x + 4y = 18$$

$$y = \frac{3}{4}x$$

Which of the following ordered pairs (x, y) is a solution of the system of equations above?

- A) (2, 3)
- B) (3, 2.25)
- C) (4, 1.5)
- D) (4, 6)

3

Which of the following is equivalent to $\frac{3x + 4}{12}$?

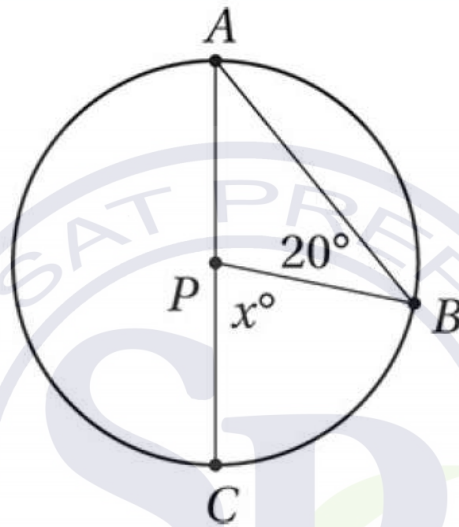
- A) $\frac{x + 4}{4}$
- B) $\frac{3x + 1}{3}$
- C) $\frac{x}{4} + \frac{1}{3}$
- D) $\frac{x}{3} + \frac{1}{4}$

4

If $x - 3$ is a factor of the expression $x^2 + kx + 12$, what is the value of k ?

- A) -7
- B) -5
- C) 5
- D) 7

5



Note: Figure not drawn to scale.

In the figure above, P is the center of a circle and AC is its diameter. What is the value of x ?

- A) 60
- B) 50
- C) 40
- D) 30

6

The n th term of a sequence is given by the expression $bn + 4$, where b is a positive constant. Which of the following is necessarily equal to b ?

- A) the value of the first term
- B) the difference between the fourth term and the third term
- C) the average (arithmetic mean) of the first three terms
- D) the ratio of the second term to the first term

7

If $m^3 = \sqrt{\sqrt{n}}$, where $n > 0$, what is the value of m in terms of n ?

- A) $n^{\frac{1}{12}}$
- B) $n^{\frac{1}{7}}$
- C) $n^{\frac{7}{12}}$
- D) $n^{\frac{3}{4}}$

8

One bag of grass seed can cover 5,000 square feet of new lawn. If each bag costs p dollars, which of the following expressions gives the cost, in dollars, to cover a new rectangular lawn that measures a feet by b feet?

- A) $\frac{5,000p}{ab}$
- B) $\frac{abp}{5,000}$
- C) $\frac{5,000ab}{p}$
- D) $5,000abp$

9

If $\frac{5}{m} \leq \frac{2}{3}$, where $m > 0$, what is the least possible value of m ?

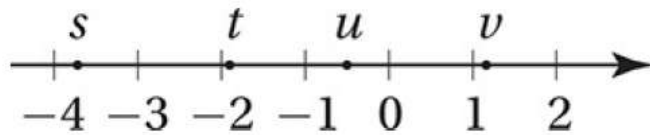
- A) 6.5
- B) 7
- C) 7.5
- D) 8

10

If $f(x) = 3x + n$, where n is a constant, and $f(2) = 0$, then $f(n) =$

- A) -24
- B) -18
- C) -12
- D) 12

11



If s , t , u , and v are the coordinates of the indicated points on the number line above, which of the following is greatest?

- A) $|s - v|$
- B) $|s - t|$
- C) $|s + v|$
- D) $|u + v|$

12

How many solutions to the equation $4 \cos x = 1$ lie between $x = 0$ and $x = 3\pi$?

- A) Two
- B) Three
- C) Four
- D) Six

13

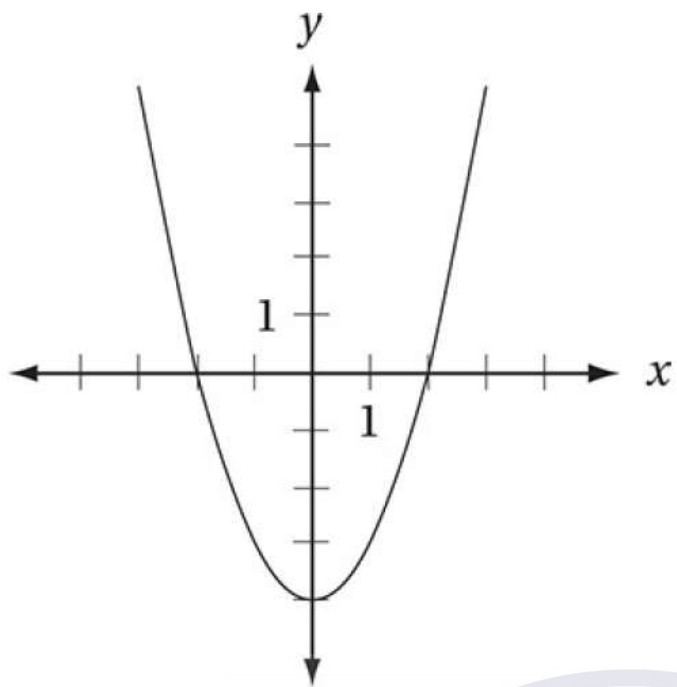
If $i = \sqrt{-1}$, which of the following is NOT equal to $i^3 + i$?

- A) $(2i)^2 + 4$
- B) $2 - 2i^4$
- C) $2i^2 - 2$
- D) $i^4 - 1$

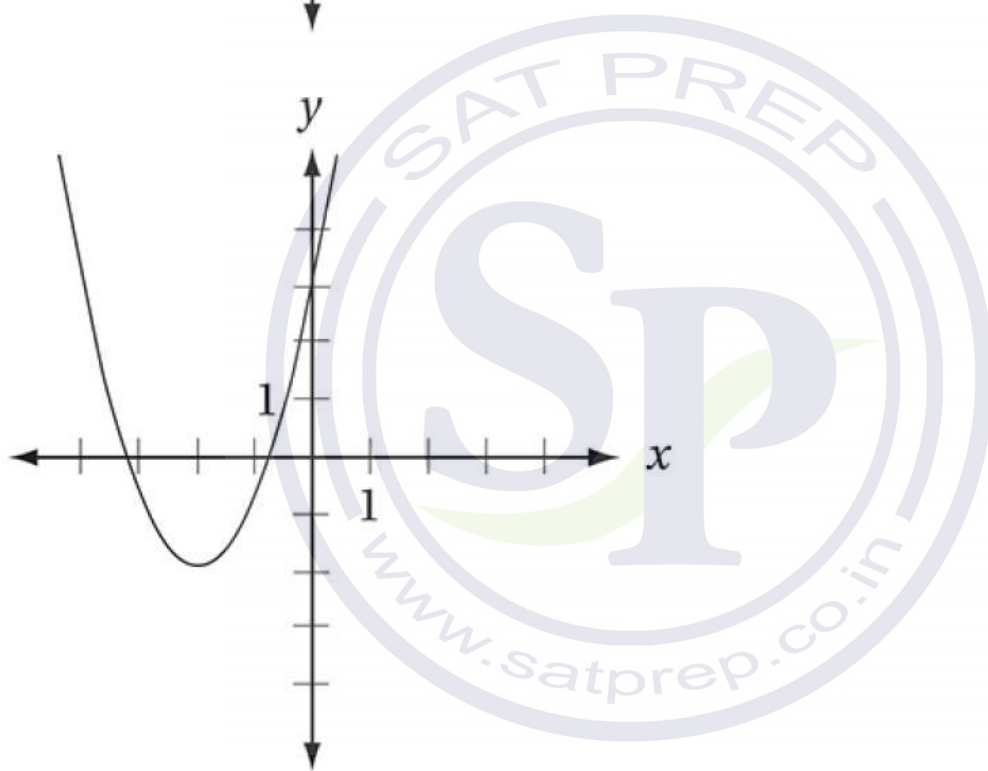
14

If $m > 1$, which of the following could be the graph of $y = -(x + m)^2 + m$ in the xy -plane?

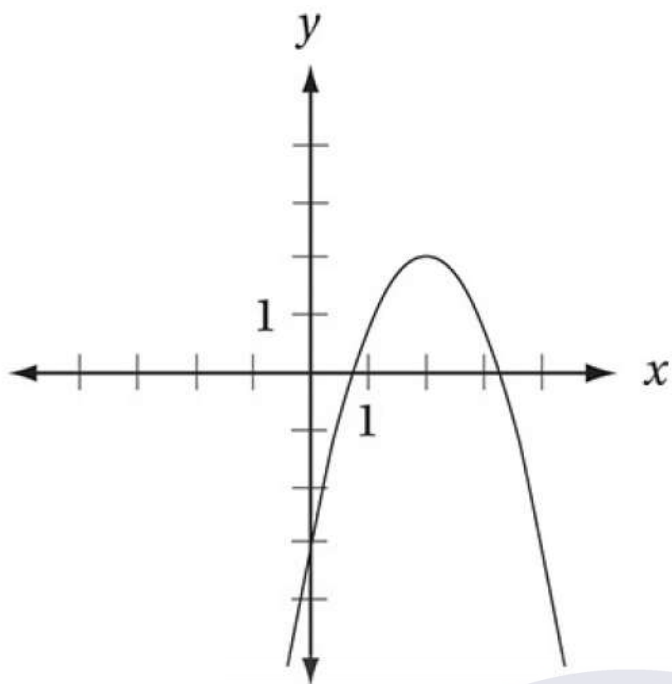
- A)



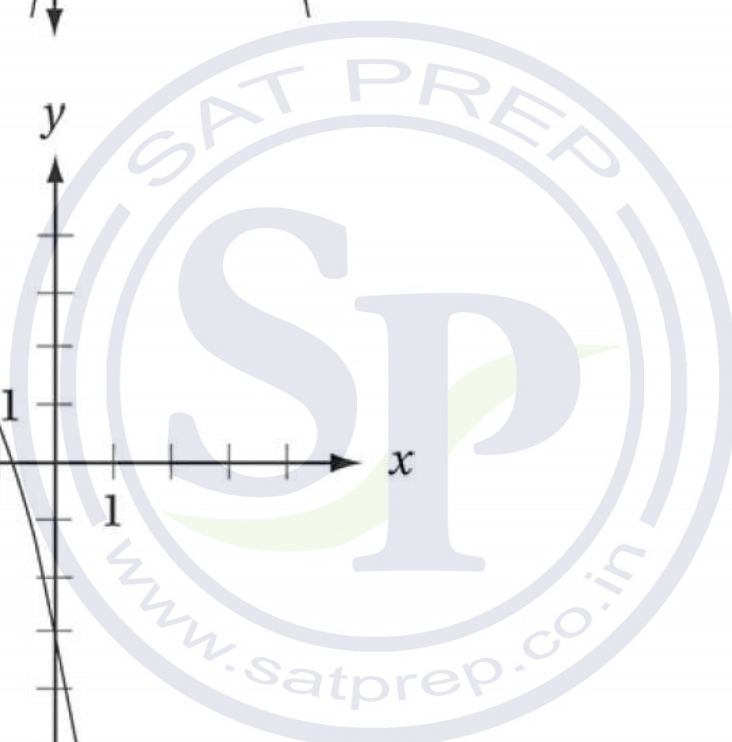
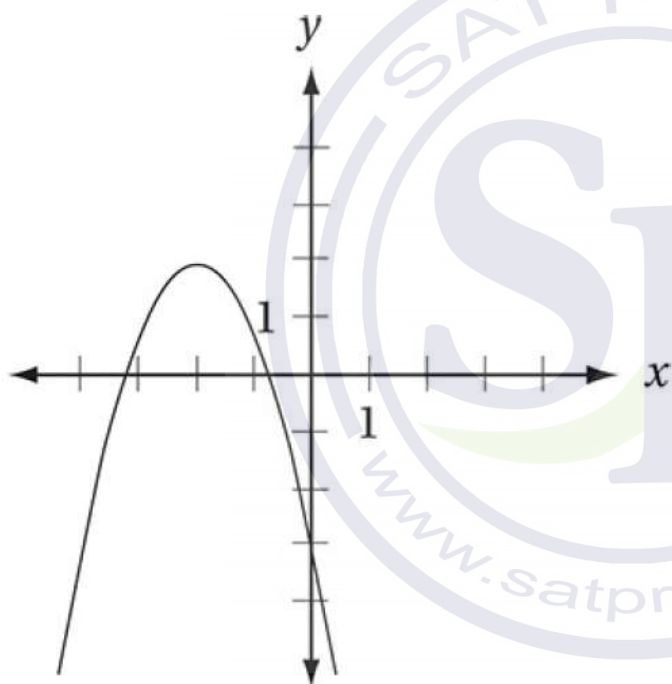
B)



C)



D)



$$x - 3y = -2$$

$$y = \frac{5}{x}$$

The values of x that satisfy the system of equations above also satisfy which of the following equations?

- A) $(x - 5)(x + 3) = 0$
- B) $(x - 3)(x + 5) = 0$
- C) $(x - 2)(x - 5) = 0$

D) $(x+2)(x+5) = 0$

DIRECTIONS

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. 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.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or $\frac{7}{2}$.

(If $3\frac{1}{2}$ is entered into the grid as

3	1	/	2
	<input type="radio"/>	<input checked="" type="radio"/>	

, it will be interpreted as $3\frac{1}{2}$, not $3\frac{1}{2}$).

6. **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.

Answer: $\frac{7}{12}$ Answer: 2.5

Write answer in boxes. →

Grid in result. →

Fraction line ←

Decimal point ←

Answer: 201

Either position is correct.

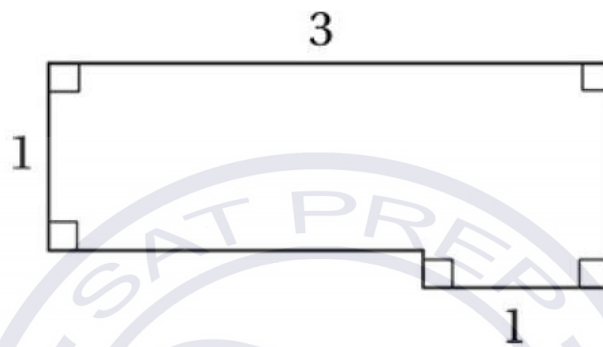
Acceptable ways to grid $\frac{2}{3}$ are:

If $\frac{2}{3}a + \frac{1}{2}b = 5$, and $b = 4$, what is the value of a ?

17

What is the smallest integer value of x such that $\frac{6}{x} + \frac{1}{2x}$ is less than 1?

18

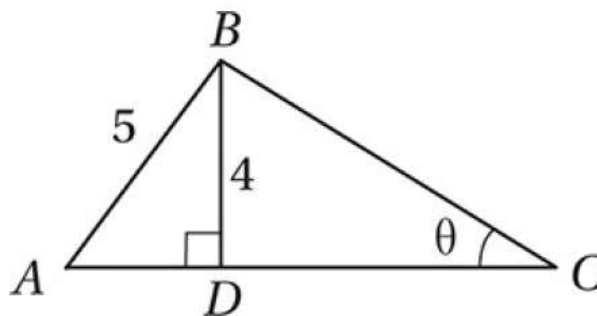


If the area of the figure above is $\frac{16}{5}$ square units, what is its perimeter?

19

What is one possible solution to the equation $\frac{6}{x+1} - \frac{3}{x-1} = \frac{1}{4}$?

20



In the figure above, triangle ABC has an area of 19. What is the value of $\tan \theta$?

STOP



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

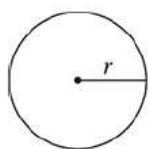
DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

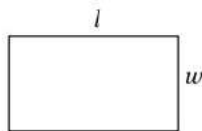
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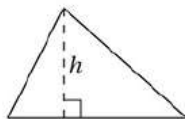


$$A = \pi r^2$$

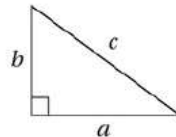
$$C = 2\pi r$$



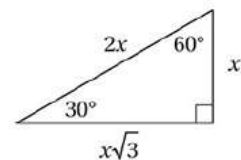
$$A = lw$$



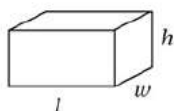
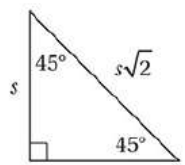
$$A = \frac{1}{2}bh$$



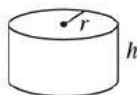
$$c^2 = a^2 + b^2$$



Special Right Triangles



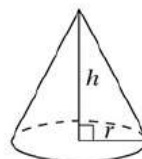
$$V = lwh$$



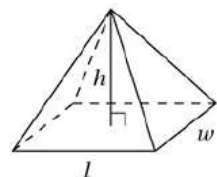
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

1

The fraction $\frac{n}{20}$ is equal to 0.8. What is the value of n ?

- A) 4
- B) 8
- C) 12
- D) 16

2

The median of the numbers x , 10, and 12 is 12. Which of the following CANNOT be the value of x ?

- A) 8
- B) 12
- C) 16
- D) 20

3

x	y
0	2
1	4
2	6
4	8

Based on the ordered pairs in the table above, which of the following could express a relationship

between x and y ?

- A) $y = x + 4$
- B) $y = 2x$
- C) $y = 2x + 2$
- D) $y = 2x + 4$

4

The average (arithmetic mean) of a set of 3 positive integers is m . If the number 24 is added to this set, what is the average (arithmetic mean) of the new set of numbers?

- A) $\frac{3m + 24}{24}$
- B) $\frac{3m + 24}{4}$
- C) $m + 8$
- D) $\frac{m + 24}{4}$

5

If $\frac{6}{x} + 3 = -1$, what is the value of x ?

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

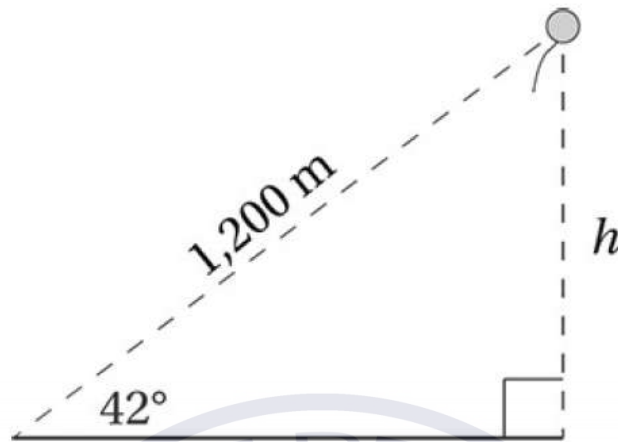
6

The Municipal Electric Company charges each household \$0.15 per kilowatt-hour of electricity plus a flat monthly service fee of \$16. If a household uses 30 kilowatt-hours of electricity and is charged $\$P$ in a given month, which of the following equations is true?

- A) $0.15(30) + 16 = P$
- B) $0.15P + 16 = 30$
- C) $\frac{30}{0.15} + 16 = P$

D) $\frac{0.15}{P} + 16 = 30$

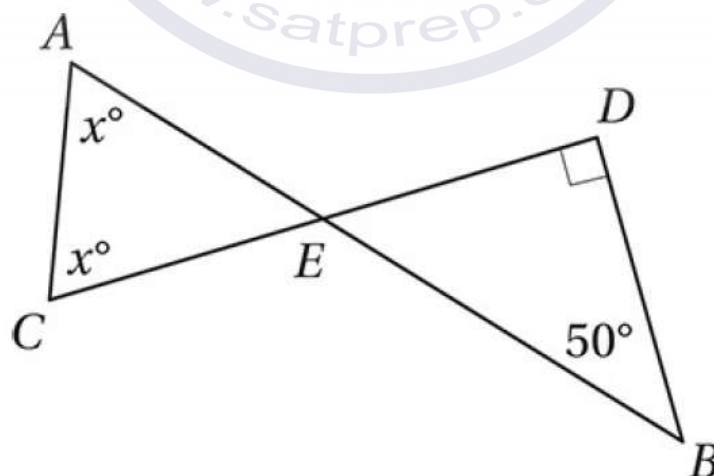
7



Alyssa determines that a floating balloon is 1,200 meters away from her at an angle of 42° from the ground, as in the figure above. What is the height, h , of the balloon from the ground? ($\sin 42^\circ = 0.669$, $\cos 42^\circ = 0.743$, $\tan 42^\circ = 0.900$)

- A) 802.8 meters
- B) 891.6 meters
- C) 1,080 meters
- D) 1,793 meters

8

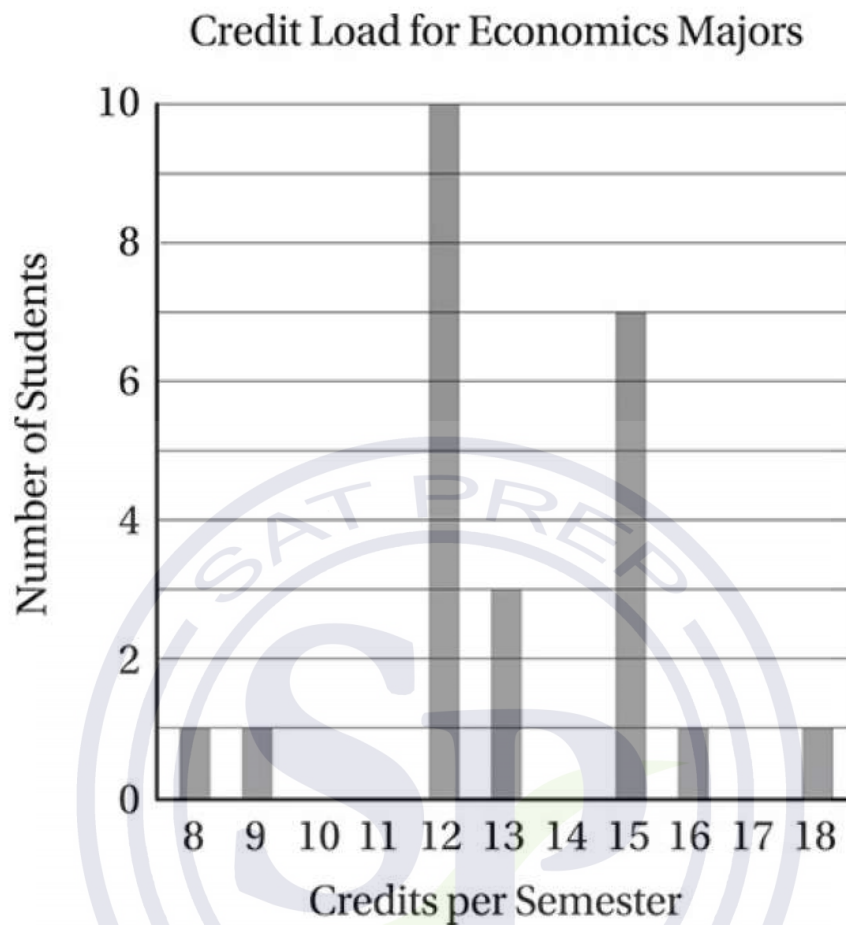


In the figure above, line segments \overline{AB} and \overline{CD} intersect at point E . What is the value of x ?

- A) 60°
- B) 65°
- C) 70°

D) 75°

Questions 9 and 10 are based on the graph below.



9

A university surveyed 24 economics majors and asked them how many credits they received the previous semester. The results are represented in the graph above. What percentage of these students received 15 or more credits that semester?

- A) 29%
- B) $33\frac{1}{3}\%$
- C) $37\frac{1}{2}\%$
- D) 54%

10

What is the median number of credits these students received the previous semester?

- A) 10.5

- B) 11.5
- C) 12
- D) 12.5

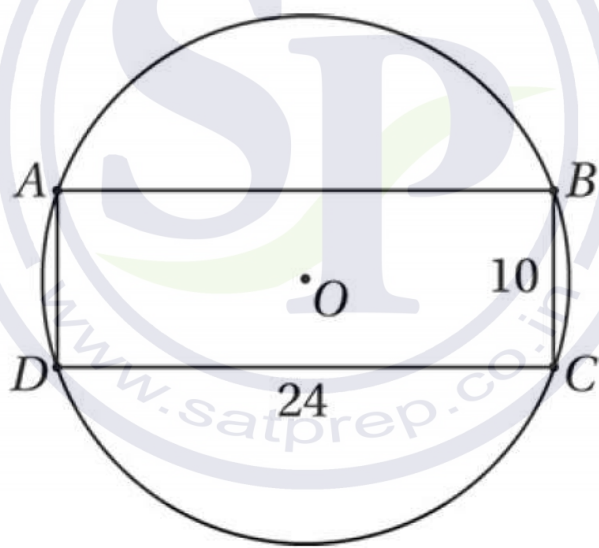


11

If a and b are the coordinates of two points on the number line, then which of the following is equivalent to the statement that the absolute distance from a to b is greater than the absolute distance from -2 to 6 ?

- A) $|a| > -2$ and $|b| > 6$
- B) $|a - b| > -8$
- C) $|a + 2| > |b - 6|$
- D) $|a - b| > 8$

12



Note: Figure not drawn to scale.

In the figure above, rectangle $ABCD$ is inscribed in the circle with center O . What is the area of the circle?

- A) 26π
- B) 121π
- C) 144π
- D) 169π

13

Everyone in Niko's class has a different birth date. If Niko is both the 8th oldest person and the 12th youngest person in his class, how many students are in Niko's class?

- A) 18
- B) 19
- C) 20
- D) 21

14

If $i = \sqrt{-1}$, which of the following is equivalent to $(2 - i)(3 - 2i)$?

- A) $8 - 7i$
- B) $6 + 2i$
- C) $6 - 6i$
- D) $4 - 7i$

15

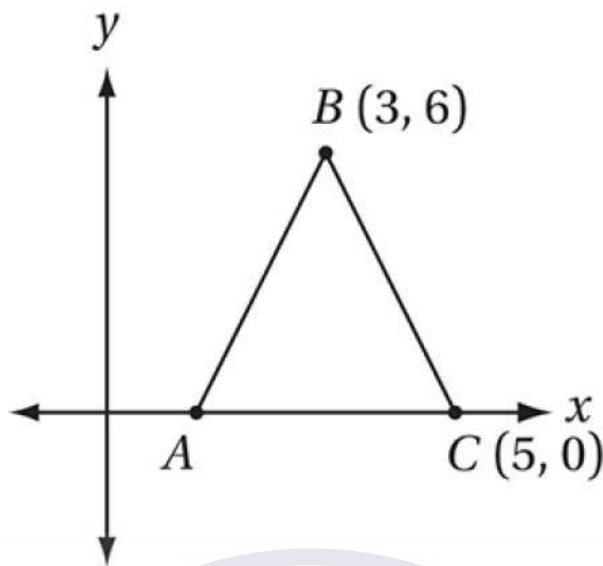
If $f(x) = (x^2)^{-2b}$ and $f(3) = 3$, what is the value of b ?

- A) $-\frac{1}{2}$
- B) $-\frac{1}{4}$
- C) $\frac{1}{4}$
- D) $\frac{1}{2}$

16

In a survey of 80 students, 55 students stated that they play a varsity sport, and 35 stated that they are taking at least one AP level course. Which of the following statements must be true?

- A) At least 10 of these students are both playing a varsity sport and taking at least one AP level course.
- B) Less than half of the students who play a varsity sport are also taking at least one AP level course.
- C) The number of students who do not play a varsity sport is greater than the number of students who do not take at least one AP level course.
- D) At least one student who takes an AP level course does NOT play a varsity sport.



Note: Figure not drawn to scale.

In the figure above, $AB = BC$. If \overline{AB} has a slope of m and \overline{BC} has a slope of n , what is the value of mn ?

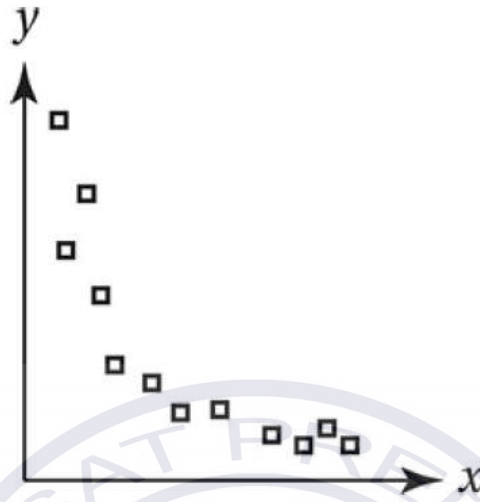
- A) -9
- B) $-\frac{1}{9}$
- C) $\frac{1}{9}$
- D) 9

The functions f , g , and h are defined by the equations $f(x) = x^2$, $g(x) = x$, and $h(x) = \sqrt{x}$. Which of the following must be true?

- A) $h\left(\frac{1}{2}\right) < f\left(\frac{1}{2}\right) < g\left(\frac{1}{2}\right)$
- B) $h\left(\frac{1}{2}\right) < g\left(\frac{1}{2}\right) < f\left(\frac{1}{2}\right)$
- C) $g\left(\frac{1}{2}\right) < h\left(\frac{1}{2}\right) < f\left(\frac{1}{2}\right)$
- D) $f\left(\frac{1}{2}\right) < g\left(\frac{1}{2}\right) < h\left(\frac{1}{2}\right)$

Which of the following scatterplots provides the strongest evidence in support of the hypothesis that y varies inversely as the square of x ?

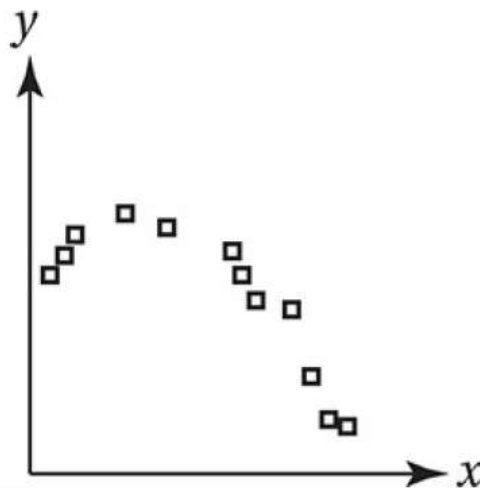
A)



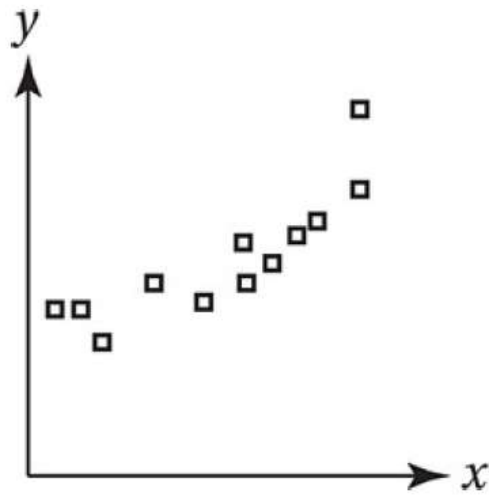
B)



C)



D)



20

The bird department of a pet store has 12 canaries, 30 finches, and 18 parrots. If the pet store purchased n more finches, then 80% of its birds would be finches. Which of the following equations must be true?

- A) $\frac{1}{2} + n = \frac{4}{5}$
- B) $\frac{30 + n}{60} = \frac{4}{5}$
- C) $\frac{30 + n}{60 + n} = \frac{4}{5}$
- D) $\frac{n}{60 + n} = \frac{4}{5}$

21

Let function $f(x)$ be defined by the equation $f(x) = x^2 - 1$. If b is a positive real number, then

$$f\left(\frac{1}{b}\right) =$$

- A) $\frac{(b-1)(b+1)}{b^2}$
- B) $\frac{(1-b)(1+b)}{b^2}$
- C) $\frac{b^2 - 1}{b}$

D) $\frac{b-1}{b^2}$

22

The value of y varies with x according to the equation $y = kx^2$, where $k > 0$. When the value of x increases from 3 to 12, which of the following best describes the behavior of y ?

- A) It increases by 81.
- B) It increases by 135.
- C) It is multiplied by 4.
- D) It is multiplied by 16.

23

If the function f is defined by the equation $f(x) = k(x+6)(x-1)$, where $k > 5$, then which of the following is equivalent to $f(7)$?

- A) $f(-78)$
- B) $f(-12)$
- C) $f(-2)$
- D) $f(78)$

24

After its initial offering, the price of a stock increased by 20% in the first year, decreased by 25% in the second year, then increased by 10% in the third year. What was the net change in the stock price over the entire three-year period?

- A) It increased by 5%.
- B) It increased by 1%.
- C) It decreased by 1%.
- D) It decreased by 5%.

25

If $y = x^2$, where $x \neq 0$, and $w = y^6$, which of the following expresses the value of $\frac{w}{y^3}$ in terms of x ?

- A) x^2
- B) x^4
- C) x^5

D) x^6

26

0	1	2	3	4	5
1	2	4	7		
2					
3					
4				x	
5					

With the exception of the shaded squares in the first row and first column, every square in the table above is to be filled in with a number equal to the sum of the number directly above it and the number directly to its left. For instance, the number 7 in the second row is the sum of 3 in the square above it and 4 in the square directly to its left. What is the value of x ?

- A) 16
- B) 84
- C) 96
- D) 112

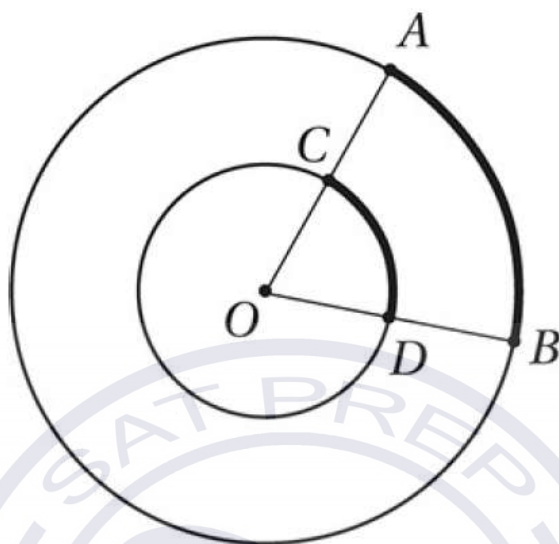
27

$$3x^2 = 4x + c$$

In the equation above, c is a constant. If $x = -1$ is a solution of this equation, what other value of x satisfies the equation?

- A) $\frac{1}{7}$
- B) $\frac{4}{3}$

- $\frac{7}{3}$
 C) $\frac{7}{3}$
 D) 7



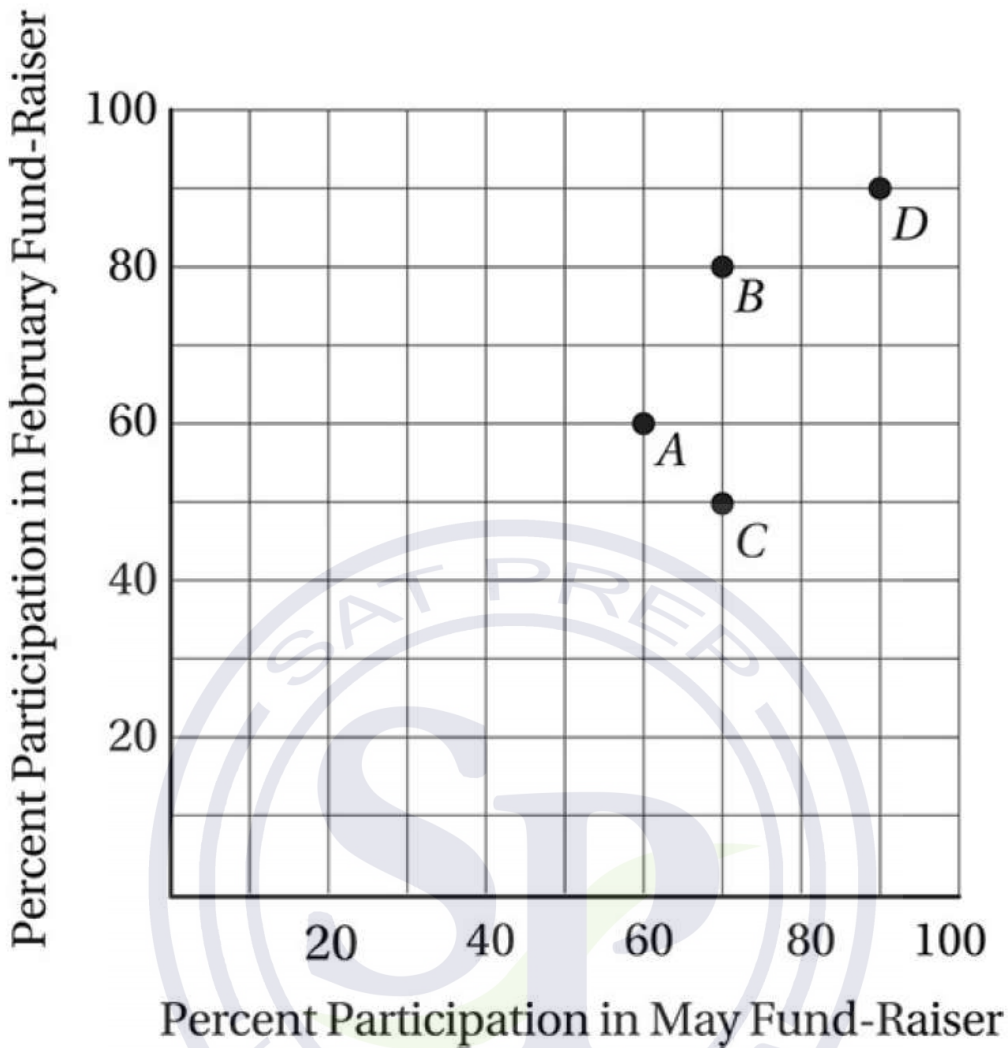
Note: Figure not drawn to scale.

The figure above shows two concentric circles with center O. If $OD = 3$, $DB = 5$, and the length of arc AB is 5π , what is the length of arc CD?

- A) $\frac{7}{4}\pi$
 B) $\frac{15}{8}\pi$
 C) 3π
 D) $\frac{25}{8}\pi$

Questions 29 and 30 refer to the following graph.

PARTICIPATION IN FUND-RAISERS
FOR FOUR CLASSES



29

Four different classes at Corbett Elementary School participated in two fund-raisers last year, one in February and another in May. The rates of participation for each class are recorded in the graph above. Which class had the greatest change in percent participation from the February fund-raiser to the May fund-raiser?

- A) Class A
- B) Class B
- C) Class C
- D) Class D

30

If there were 20 students each in Class A and Class C, and 30 students each in Class B and Class D, how many students participated in the May fund-raiser?

- A) 71

- B) 72
 - C) 74
 - D) 76
-
-

DIRECTIONS

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

1. 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.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or $\frac{7}{2}$.

(If $3\frac{1}{2}$ is entered into the grid as

3	1	/	2
	<input type="radio"/>	<input checked="" type="radio"/>	

, it will be interpreted as $3\frac{1}{2}$, not $3\frac{1}{2}$.)

6. **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.

Answer: $\frac{7}{12}$ Answer: 2.5

Write answer in boxes. →

Grid in result. →

Fraction line ←

Decimal point ←

Answer: 201
Either position is correct.

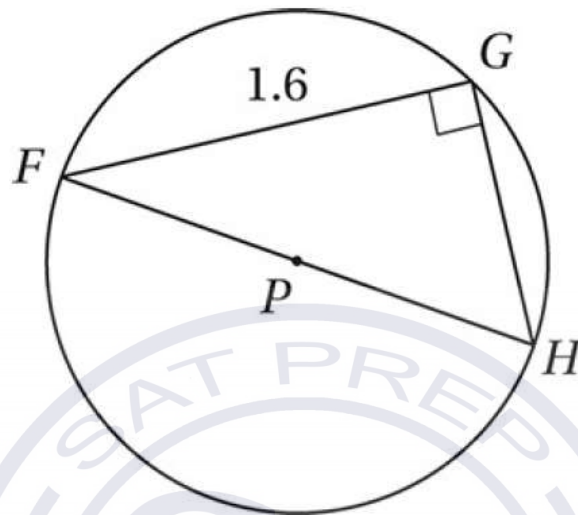
Acceptable ways to grid $\frac{2}{3}$ are:

If $4 + \sqrt{b} = 7.2$, what is the value of $4 - \sqrt{b}$?

32

In the xy -plane, the graph of the equation $y = 3x^2 - kx - 35$ intersects the x -axis at $(5, 0)$. What is the value of k ?

33



In the figure above, triangle FGH is inscribed in the circle with center P . If the area of the circle is π , what is the area of triangle FGH ?

34

If $-\frac{3}{5} < -2t + 1 < -\frac{3}{7}$, what is one possible value of $6t$?

35

If $\cos(x - \pi) = 0.4$, what is the value of $\sin^2 x$?

36

If one pound of grain can feed either 5 chickens or 2 pigs, then ten pounds of grain can feed 20 chickens and how many pigs?

Questions 37 and 38 are based on the following information

Section	Price per Ticket	Number Sold
Front Orchestra	\$60	50
Rear Orchestra	\$50	60
First Mezzanine	\$40	x
Second Mezzanine	\$35	y
Third Mezzanine	\$30	100

The table above shows information about the tickets sold for a recent performance by a theater troupe. The total revenue in ticket sales for this performance was \$15,000.

37

If 15 more tickets were sold in the second mezzanine than in the first mezzanine, what is the total number of tickets that were sold for this performance?

38

Before the tickets for this performance went on sale, a consultant for the theater had predicted that n , the number of tickets sold per section, would vary with p , the price in dollars for a ticket in that section, according to the formula $n = \frac{2,800}{p}$. By how many tickets did this model underestimate the actual total number of tickets sold?

STOP

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