



MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

-
1. Xuan sold 9 used books for \$9.80 each. With the money from these sales, she bought 4 new books and had \$37.80 left over. What was the average amount Xuan paid for each new book?

- A. \$ 5.60
- B. \$ 9.45
- C. \$10.08
- D. \$12.60
- E. \$22.05

DO YOUR FIGURING HERE.

2. A point at $(-5,7)$ in the standard (x,y) coordinate plane is translated right 7 coordinate units and down 5 coordinate units. What are the coordinates of the point after the translation?

- F. $(-12,12)$
- G. $(0, 0)$
- H. $(2, 2)$
- J. $(-2,12)$
- K. $(12,12)$

3. Shantiel left her home at 9:00 a.m. on Tuesday and traveled 648 miles. When she arrived at her destination it was 3:00 a.m. the next day. Given that her home and her destination are in the same time zone, which of the following is closest to her average speed, in miles per hour, for this trip?

- A. 72
- B. 54
- C. 36
- D. 31
- E. 18



4. The text message component of each of Juan's monthly phone bills consists of \$10.00 for the first 300 text messages sent that month, plus \$0.10 for each additional text message sent that month. On Juan's most recent phone bill he was charged a total of \$16.50 for text messages. For how many text messages in total was Juan charged on this bill?

F. 235
G. 285
H. 315
J. 365
K. 465

DO YOUR FIGURING HERE.

5. Which of the following matrices is equal to

$$\begin{bmatrix} 9 & 8 \\ -4 & 7 \end{bmatrix} + \begin{bmatrix} -6 & 6 \\ 5 & 4 \end{bmatrix} ?$$

A. $\begin{bmatrix} 3 & 14 \\ 1 & 11 \end{bmatrix}$
B. $\begin{bmatrix} 3 & 14 \\ 9 & 11 \end{bmatrix}$
C. $\begin{bmatrix} 15 & 14 \\ 9 & 11 \end{bmatrix}$
D. $\begin{bmatrix} 17 & 0 \\ 3 & 9 \end{bmatrix}$
E. $\begin{bmatrix} -14 & 86 \\ 59 & 4 \end{bmatrix}$

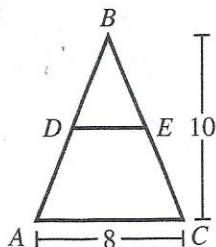
6. A function, f , is defined by $f(x,y) = 3x^2 - 4y$. What is the value of $f(4,3)$?

F. 11
G. 24
H. 36
J. 65
K. 132

7. A certain group consists of 5 children, 3 of whom are age 10 and 2 of whom are age 5. What is the mean age of the children in the group?

A. 5
B. 7
C. 7.5
D. 8
E. 10

8. In the figure shown below, $\overline{AC} \parallel \overline{DE}$; $BD = AD$; D and E are on \overline{AB} and \overline{BC} , respectively; $AC = 8$ feet; and the height of $\triangle ABC$ is 10 feet. What is DE , in feet?



F. 2
G. 3
H. 4
J. 5
K. 6



9. In a poll of 500 registered voters, 337 voters favored a proposal to increase funding for local schools. Suppose the poll is indicative of how the 22,000 registered voters will vote on the proposal. Which of the following values is closest to how many of the 22,000 registered voters will be expected to vote in favor of the proposal?

A. 13,200
 B. 14,830
 C. 21,840
 D. 22,000
 E. 32,640

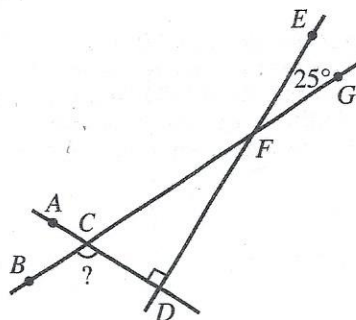
10. Diego purchased a car that had a purchase price of \$13,400, which included all other costs and tax. He paid \$400 as a down payment and got a loan for the rest of the purchase price. Diego paid off the loan by making 48 payments of \$300 each. The total of all his payments, including the down payment, was how much more than the car's purchase price?

F. \$ 1,000
 G. \$ 1,400
 H. \$13,000
 J. \$14,400
 K. \$14,800

11. In the standard (x,y) coordinate plane, what is the slope of the line $4x + 7y = 9$?

A. $-\frac{4}{7}$
 B. $\frac{4}{9}$
 C. -4
 D. 4
 E. 9

12. In the figure below, \overleftrightarrow{AD} intersects \overleftrightarrow{BG} at C and is perpendicular to \overleftrightarrow{DE} . Line \overleftrightarrow{DE} intersects \overleftrightarrow{BG} at F . Given that the measure of $\angle EFG$ is 25° , what is the measure of $\angle BCD$?



F. 65°
 G. 115°
 H. 120°
 J. 130°
 K. 155°

DO YOUR FIGURING HERE.



13. What is the sum of the 2 solutions of the equation $x^2 + x - 30 = 0$?

A. -30
 B. -6
 C. -1
 D. 0
 E. 5

14. The volume of a sphere is $\frac{4\pi r^3}{3}$, where r is the radius of the sphere. What is the volume, in cubic yards, of a sphere with a *diameter* of 4 yards?

F. $\frac{32}{3}\pi$
 G. $\frac{64}{3}\pi$
 H. 32π
 J. 48π
 K. $\frac{256}{3}\pi$

15. What is the smallest integer greater than $\sqrt{85}$?

A. 5
 B. 9
 C. 10
 D. 12
 E. 43

16. The 3 statements below are true for the elements of sets A , B , C , and D .

- I. All elements of A are elements of B .
 II. All elements of C are elements of D .
 III. No elements of D are elements of B .

Which of the following statements *must* be true?

F. All elements of A are elements of C .
 G. All elements of B are elements of D .
 H. All elements of C are elements of B .
 J. No elements of A are elements of B .
 K. No elements of A are elements of C .

17. In the standard (x,y) coordinate plane, the midpoint of \overline{AB} is at $(2,1)$, and A is at $(8,10)$. What is the x -coordinate of B ?

A. -4
 B. -6
 C. -8
 D. 3
 E. 5

DO YOUR FIGURING HERE.





18. Lena will pick 1 card at random from a pack of 25 baseball cards. Each card features the fielding position for 1 of 25 different baseball players. Each player in the pack has only 1 fielding position. The table below lists the frequency of fielding positions in the pack. What is the probability that the card Lena picks will feature an outfielder or a pitcher?

Fielding position	Frequency
Catcher	4
Infielder	6
Pitcher	8
Outfielder	7

- F. 9%
 G. 28%
 H. 32%
 J. 56%
 K. 60%
19. According to a soil analysis, a certain lawn requires an application of 40.0 kg of nitrogen phosphate when the average temperature is 75.0°F. To avoid burning the grass, the required application amount decreases 1.2 kg for each 1.0°F that the average temperature is above 75.0°F. To the nearest 0.1 kg, what is the required application amount of nitrogen phosphate when the average temperature is 83.0°F?
- A. 30.4
 B. 30.8
 C. 33.3
 D. 38.4
 E. 38.8
20. In the figure below, all segments that meet do so at right angles. What is the area, in square units, of the shaded region?

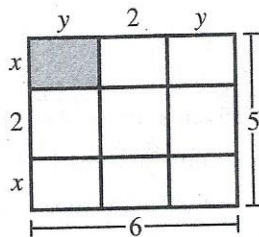
F. $2\frac{1}{4}$

G. 3

H. $3\frac{1}{3}$

J. 4

K. 7

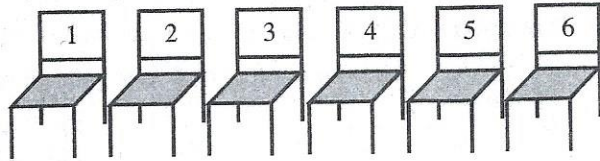


21. The perimeter of a certain scalene triangle is 100 inches. The side lengths of the triangle are represented by $5x$, $3x + 30$, and $2x + 10$, respectively. What is the length, in inches, of the longest side of the triangle?
- A. 6
 B. 22
 C. 30
 D. 48
 E. 72

DO YOUR FIGURING HERE.



22. The mayor of Westbrook is deciding how to assign the 6 council members to the row of seats below.



From how many different arrangements can she choose?

- F. 21
 G. 36
 H. 64
 J. 720
 K. 6,000,000
23. The sum of 2 and 200% of 1 has the same value as which of the following calculations?
- A. 100% of 2
 B. 150% of 2
 C. 300% of 2
 D. 300% of 1
 E. 400% of 1

24. The graph in the standard (x,y) coordinate plane below is represented by one of the following equations. Which equation?

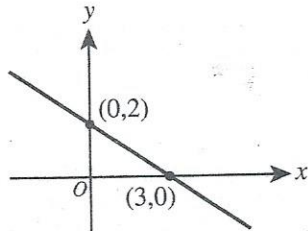
F. $y = -\frac{3}{2}x + 2$

G. $y = -\frac{3}{2}x + 3$

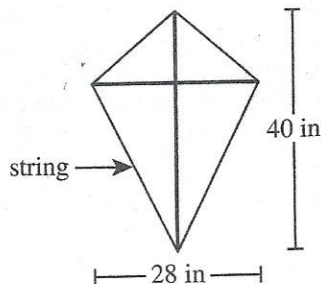
H. $y = -\frac{2}{3}x + 2$

J. $y = -\frac{2}{3}x + 3$

K. $y = \frac{2}{3}x + 2$



25. Kamini is constructing the kite shown below. The kite includes 2 perpendicular supports, one of length 40 inches and the other of length 28 inches. The ends of the supports are connected with string to form a 4-sided figure that is symmetric with respect to the longer support. A layer of paper will cover the interior of the 4-sided figure. Which of the following is closest to the area, in square inches, that Kamini will cover with paper?



- A. 101
 B. 280
 C. 560
 D. 840
 E. 980

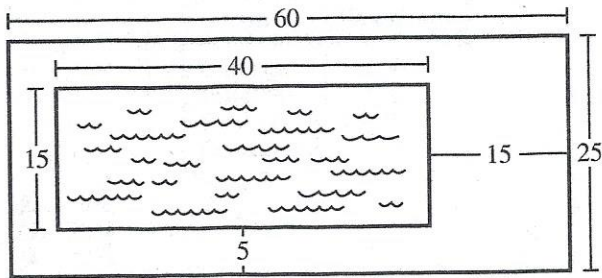
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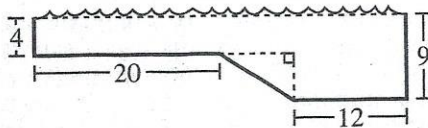
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Use the following information to answer questions 26–29.

The top view and side view of a 40-foot-long swimming pool are shown in the figure below. All dimensions given are in feet.



top view



side view

The top view shows the top rectangular surface of the pool and the surrounding rectangular patio. All 4 walls of the pool are vertical and perpendicular to the top surface. The side view shows a cross section along the length of the pool. All cross sections parallel to the side view are congruent. The shallow end has a constant depth of 4 ft. The deep end has a constant depth of 9 ft. A rectangular surface connects the shallow and deep ends.

26. What is the area, in square feet, of the patio surrounding the pool?
- F. 500
G. 600
H. 900
J. 1,100
K. 1,350
27. Johann put up a fence along the outer edge of the patio. Given that the materials for the fence cost \$12 per foot, what was the total cost of the materials for the fence?
- A. \$1,020
B. \$1,320
C. \$1,800
D. \$2,040
E. \$3,360



DO YOUR FIGURING HERE.

28. A full lap is 2 times the length of the pool. Johann swam 5 full laps of the pool in $4\frac{1}{2}$ minutes. Which of the following values is closest to Johann's average swimming speed, in feet per minute?

F. 35
 G. 45
 H. 60
 J. 90
 K. 120

29. The side view of the pool is placed in the standard (x,y) coordinate plane, keeping the same orientation and scale, such that both vertical segments showing depth are parallel to the y -axis. Which of the following values is closest to the slope of the line segment connecting the shallow end to the deep end?

A. -0.44
 B. -0.63
 C. -0.75
 D. -1.33
 E. -1.60

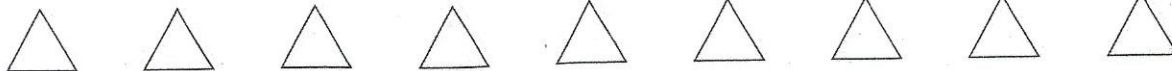
30. A construction company builds 3 different models of houses (A, B, and C). They order all the bathtubs, shower stalls, and sinks for the houses from a certain manufacturer. Each model of house contains different numbers of these bathroom fixtures. The tables below give the number of each kind of these fixtures required for each model and the cost to the company, in dollars, of each type of fixture.

Fixture	Model		
	A	B	C
Bathtubs	1	1	2
Shower stalls	0	1	1
Sinks	1	2	4

Fixture	Cost
Bathtub	\$250
Shower stall	\$150
Sink	\$120

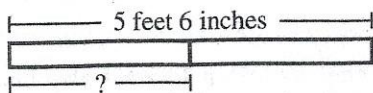
The company plans to build 3 A's, 4 B's, and 6 C's. What will be the cost to the company of exactly enough of these bathroom fixtures to put the required number in all of these houses?

F. \$ 1,940
 G. \$ 2,070
 H. \$ 8,940
 J. \$ 9,180
 K. \$10,450



DO YOUR FIGURING HERE.

31. Shown below, a board 5 feet 6 inches long is cut into 2 equal parts. What is the length, to the nearest inch, of each part?



- A. 2 feet 5 inches
 B. 2 feet 8 inches
 C. 2 feet 9 inches
 D. 3 feet 0 inches
 E. 3 feet 5 inches
32. A company that builds bridges used a pile driver to drive a post into the ground. The post was driven 18 feet into the ground by the first hit of the pile driver. On each hit after the first hit, the post was driven into the ground an additional distance that was $\frac{2}{3}$ the distance the post was driven in the previous hit. After a total of 4 hits, the post was driven how many feet into the ground?
- F. $28\frac{8}{9}$
 G. 30
 H. $43\frac{1}{3}$
 J. 48
 K. 54
33. In the standard (x,y) coordinate plane, A' is the image resulting from the reflection of the point $A(2,-3)$ across the y -axis. What are the coordinates of A' ?
- A. $(-3, 2)$
 B. $(-2,-3)$
 C. $(-2, 3)$
 D. $(2, 3)$
 E. $(3,-2)$



DO YOUR FIGURING HERE.

34. To increase the mean of 4 numbers by 3, by how much would the sum of the 4 numbers have to increase?

- F. $\frac{3}{4}$
 G. 1
 H. $\frac{4}{3}$
 J. 7
 K. 12

35. Which of the following expressions is equivalent to $(3 + x)^{-100}$?

- A. $-3^{100} - x^{100}$
 B. $-300 - 100x$
 C. $\frac{1}{3^{100}} + \frac{1}{x^{100}}$
 D. $\frac{1}{(3x)^{100}}$
 E. $\frac{1}{(3 + x)^{100}}$

36. Consider the graph of the equation $y = \frac{3x - 12}{2x - 6}$ in the standard (x, y) coordinate plane. Which of the following equations represents the *vertical* asymptote of the graph?

- F. $x = 2$
 G. $x = 3$
 H. $x = 4$
 J. $x = 6$
 K. $x = 12$

37. For every pair of real numbers x and y such that $xy = 0$ and $\frac{x}{y} = 0$, which of the following statements is true?

- A. $x = 0$ and $y = 0$
 B. $x \neq 0$ and $y = 0$
 C. $x = 0$ and $y \neq 0$
 D. $x \neq 0$ and $y \neq 0$
 E. None of the statements is true for every such pair of real numbers x and y .



DO YOUR FIGURING HERE.

Use the following information to answer questions 38–40.

Walter recently vacationed in Paris. While there, he visited the Louvre, a famous art museum. Afterward, he took a 3.7-kilometer cab ride from the Louvre to the Eiffel Tower. A tour guide named Amélie informed him that 2.5 million rivets were used to build the tower, which stands 320 meters tall.

38. Walter's cab ride lasted 15 minutes. Which of the following values is closest to the average speed, in miles per hour, of the cab?

(Note: 1 mile \approx 1.6 kilometers)

- F. 9
- G. 15
- H. 21
- J. 24
- K. 35

39. When written in scientific notation, the number of rivets used to build the Eiffel Tower is equal to which of the following expressions?

- A. 2.5×10^6
- B. 2.5×10^7
- C. 2.5×10^8
- D. 25×10^6
- E. 25×10^7

40. At a certain point, the angle of elevation formed by the level ground and the line from that point to the top of the Eiffel Tower is 70° . Which of the following expressions is equal to the distance, in meters, between that point and the center of the base of the tower?

- F. $320 \cos 70^\circ$
- G. $320 \sin 70^\circ$
- H. $320 \tan 70^\circ$
- J. $\frac{320}{\sin 70^\circ}$
- K. $\frac{320}{\tan 70^\circ}$

41. When the vector $a\mathbf{i} + 3\mathbf{j}$ is added to the vector $-2\mathbf{i} + b\mathbf{j}$, the sum is $6\mathbf{i} - 6\mathbf{j}$. What are the values of a and b ?

- A. $a = -9$ and $b = 8$
- B. $a = -8$ and $b = 9$
- C. $a = -4$ and $b = 3$
- D. $a = 4$ and $b = -3$
- E. $a = 8$ and $b = -9$



DO YOUR FIGURING HERE.

42. Given $c = 10b^3 + 50$, which of the following is an expression for b in terms of c ?

F. $\left(\frac{c}{10} - 5\right)^{\frac{1}{3}}$

G. $\left(\frac{c}{10} + 5\right)^{\frac{1}{3}}$

H. $\frac{1}{10}(c - 50)^{\frac{1}{3}}$

J. $c^3 + 5$

K. $10c^3 + 50$

43. Given $f(x) = x^2 + 3x$ and $g(x) = x + 1$, what is $f(g(x))$?

A. $x^2 + 5x + 4$

B. $x^2 + 3x + 1$

C. $x^3 + 5x^2 + 4x$

D. $x^3 + 4x^2 + 3x$

E. $x^4 + 4x^3 + 3x^2$

44. The diameter of one circle is 12 inches long. The diameter of a second circle is 25% longer than the diameter of the first circle. To the nearest square inch, how much larger is the area of the second circle than the area of the first circle?

F. 7

G. 28

H. 44

J. 64

K. 254

45. What is the product of the mean and the median of the first 6 prime numbers?

(Note: 2 is the first prime number.)

A. 27

B. 37

C. 39

D. 41

E. 42

46. For all real values of x , which of the following equations is true?

F. $\sin(7x) + \cos(7x) = 7$

G. $\sin(7x) + \cos(7x) = 1$

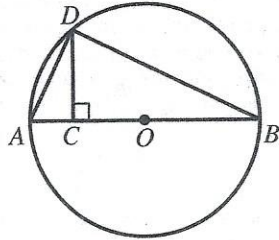
H. $7 \sin(7x) + 7 \cos(7x) = 14$

J. $\sin^2(7x) + \cos^2(7x) = 7$

K. $\sin^2(7x) + \cos^2(7x) = 1$



47. In the figure shown below, A , B , and D lie on a circle whose center is O , a diameter is \overline{AB} , \overline{CD} is perpendicular to \overline{AB} at C , the length of \overline{AD} is 5 m, and the length of \overline{BD} is 12 m. What is the length, in meters, of \overline{CD} ?



- A. $\frac{60}{13}$
 B. $\frac{65}{12}$
 C. 13
 D. $\frac{156}{5}$
 E. 60
48. If a and b are real numbers such that $a > 0$ and $b < 0$, then which of the following is equivalent to $|a| - |b|$?
- F. $|a - b|$
 G. $|a + b|$
 H. $|a| + |b|$
 J. $a - b$
 K. $a + b$
49. If $x < y$ and $y < 4$, then what is the greatest possible integer value of $x + y$?
- A. 0
 B. 3
 C. 4
 D. 7
 E. 8
50. Given that y varies directly as the square of x , if $y = 20$ when $x = 2$, what is y when $x = 3$?
- F. 75
 G. 45
 H. 30
 J. 21
 K. 15

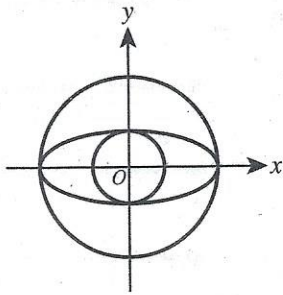
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DO YOUR FIGURING HERE.

51. Shown below in the standard (x,y) coordinate plane are 2 circles and 1 ellipse, each centered at $(0,0)$. The larger circle has equation $x^2 + y^2 = 25$ and intersects the ellipse at exactly 2 points, both on the x -axis. The smaller circle has equation $x^2 + y^2 = 4$ and intersects the ellipse at exactly 2 points, both on the y -axis. Which of the following equations represents the ellipse?

- A. $\frac{x^2}{2} + \frac{y^2}{5} = 1$
 B. $\frac{x^2}{4} + \frac{y^2}{25} = 1$
 C. $\frac{x^2}{5} + \frac{y^2}{2} = 1$
 D. $\frac{x^2}{25} + \frac{y^2}{4} = 1$
 E. $\frac{x^2}{100} + \frac{y^2}{16} = 1$



52. The mean of 5 integers is 52. The median of these 5 integers is 82. Three of the integers are 0, 12, and 82. Which of the following could be one of the other integers?

- F. 52
 G. 66
 H. 84
 J. 86
 K. 105

53. An integer is *abundant* if its positive integer factors, excluding the integer itself, have a sum that is greater than the integer. How many of the integers 6, 8, 10, and 12 are abundant?

- A. 0
 B. 1
 C. 2
 D. 3
 E. 4

54. Vanna walked at a rate of 2 miles per hour for 10 minutes and then walked at a rate of 3 miles per hour for 5 minutes. Which of the following gives the average rate, in miles per hour, at which she walked over this 15-minute period?

- F. $\frac{1}{3}$
 G. $\frac{7}{3}$
 H. $\frac{7}{24}$
 J. $\frac{7}{180}$
 K. $\frac{35}{2}$



55. The ratio of Alani's height to Baahir's height is 5:7. The ratio of Baahir's height to Connor's height is 4:3. What is the ratio of Alani's height to Connor's height?

A. 2:3
 B. 8:11
 C. 15:28
 D. 20:21
 E. 28:15

56. For all $x > 0$, which of the following expressions is NOT equivalent to $\sqrt{\sqrt[3]{x^2}}$?

F. $\sqrt[3]{x}$
 G. $\sqrt[6]{x^2}$
 H. $\sqrt[3]{\sqrt{x^2}}$
 J. $x^{\frac{1}{3}}$
 K. $x^{\frac{2}{3}}$

57. If the length of a rectangle is increased by 25% and the width is decreased by 10%, the area of the resulting rectangle is larger than the area of the original rectangle by what percent?

A. 2.5%
 B. 12.5%
 C. 15%
 D. 22.5%
 E. 35%

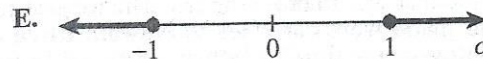
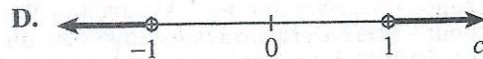
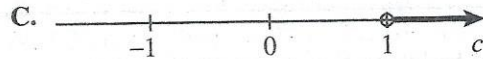
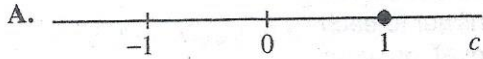
58. Five balls, numbered 1, 2, 3, 4, and 5, are placed in a bin. Two balls are drawn at random without replacement. What is the probability that the sum of the numbers on the balls drawn is 7?

F. $\frac{1}{5}$
 G. $\frac{2}{5}$
 H. $\frac{4}{5}$
 J. $\frac{5}{9}$
 K. $\frac{4}{25}$

DO YOUR FIGURING HERE.



59. Consider the family of functions $y = f(x) = \sin x + c$, where c is a real number. Which of the following number lines represents the graph of all and only the possible values of c for which the graph of y has no x -intercepts?



60. Tameka calculates that she needs 360 square feet of new carpet. But the type of carpet that she wants is priced by the square yard. How many square yards of carpet does she need?

- F. 15
G. 40
H. 60
J. 90
K. 120

DO YOUR FIGURING HERE.

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.