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.

DO YOUR FIGURING HERE.

1. $|3(-2)+4| = ?$

   A. -2
   B. 2
   C. 5
   D. 9
   E. 10

2. The table below shows the income earned by 5 students from selling tickets for a school fund-raiser. Each student earned the same amount for each ticket sold.

Student	Number of tickets sold	Income earned
Aida	13	\$55.25
Beth	5	\$21.25
Charles	22	\$93.50
Darius	16	\$68.00
Ellie	8	\$34.00

   Another student, Francis, also earned that same amount for each ticket sold, for an income earned of \$123.25 from selling tickets. How many tickets did Francis sell?

   F. 26
   G. 29
   H. 33
   J. 35
   K. 38

3. What is the value of the expression $\sqrt{\frac{m}{x-3}}$ when $x=-1$ and $m=-16$?

   A. -2
   B. 2
   C. $2\sqrt{2}$
   D. $2i$
   E. $2i\sqrt{2}$

DO YOUR FIGURING HERE.

4. For all real numbers a, b, and c, the expression $ax - bx + cx$ can be written as the product of x and which of the following?

   F. $-a + b - c$
   G. $a - b - c$
   H. $a - b + c$
   J. $a + b - c$
   K. $a + b + c$

5. Hai has \$100 available to buy USB drives to back up data for his business computers. Each USB drive has a price of \$8, and Hai will pay a sales tax of 7% of the total price of the USB drives. What is the maximum number of USB drives Hai can buy?

   A. 11
   B. 12
   C. 13
   D. 14
   E. 15

6. The lengths of the legs of a right triangle are 4 miles and 5 miles, respectively. Which of the following lengths, in miles, is closest to that of the hypotenuse of the right triangle?

   F. 3.0
   G. 4.5
   H. 6.4
   J. 8.0
   K. 8.7

7. What is the least common multiple of 50, 70, and 90 ?

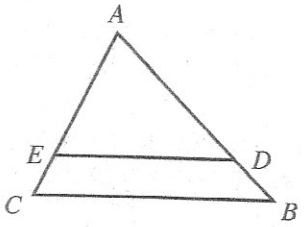
   A. 70
   B. 210
   C. 315
   D. 3,150
   E. 315,000

8. Susan makes holiday wreaths for 4 hours every Saturday. It takes her 20 minutes to make a small wreath and 30 minutes to make a large wreath. This Saturday, Susan will make twice as many large wreaths as small wreaths. How many of the large wreaths will she make this Saturday?

   F. 2
   G. 3
   H. 5
   J. 6
   K. 7

DO YOUR FIGURING HERE.

9. In $\triangle ABC$ below, D is on $\overline{AB}$, E is on $\overline{AC}$, and $\overline{ED} \parallel \overline{CB}$. If it can be determined, what is the ratio of the area of $\triangle ABC$ to the area of $\triangle ADE$?



A. 2:1
B. 3:1
C. 4:1
D. 4:3
E. Cannot be determined from the given information

10. On the real number line, point J is at -7 and point K is at -14. What is the distance between J and K ?

F. -21
G. -7
H. 7
J. $10\frac{1}{2}$
K. 21

11. A system of equations is given below. What is the value of b in the (a,b) solution to the system?

$$a = 3b - 7$$
$$a = b + 1$$

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

12. The table below gives the total charge to rent a moving truck from each of 2 movers for various numbers of miles. For what number of miles would the total charge for renting a moving truck from Ben's be the same as the total charge for renting a moving truck from Ronnie's?

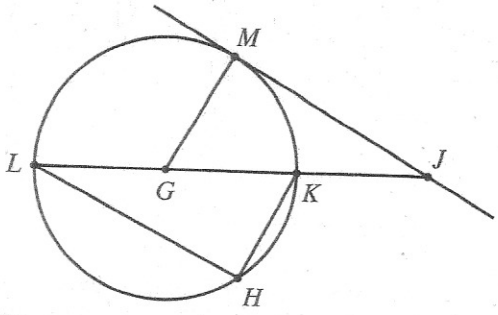
(Note: There is a linear relationship between the number of miles and the total charge for both Ben's and Ronnie's.)

Number of miles	Total charge	
	Ben's	Ronnie's
10	\$10	\$45
20	\$20	\$50
30	\$30	\$55
40	\$40	\$60
50	\$50	\$65

F. 50
G. 60
H. 70
J. 80
K. 90

DO YOUR FIGURING HERE.

13. In the figure below, G is the center of the circle, $\overline{LK}$ is a diameter, H lies on the circle, J lies outside the circle on $\overleftrightarrow{LK}$, and $\overleftrightarrow{JM}$ is tangent to the circle at M. Which of the following angles or minor arcs has the greatest degree measure?

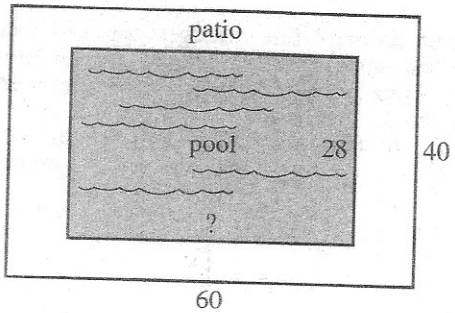


A. $\overset{\frown}{LM}$
B. $\overset{\frown}{MK}$
C. $\angle JMG$
D. $\angle LHK$
E. $\angle MJL$

14. A bowl contains 6 red beads, 8 black beads, and a number of green beads. There are no other beads in the bowl. The probability of randomly choosing a black bead from the bowl is $\frac{1}{3}$. How many green beads are in the bowl?

F. 4
G. 7
H. 10
J. 24
K. 28

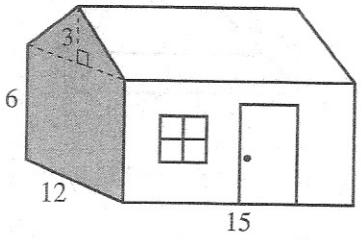
15. In the figure below, the border of a pool and the border of a patio surrounding that pool are similar rectangles. The given dimensions are in feet. What is the length of the pool, in feet?



A. 30
B. 40
C. 42
D. 48
E. 52

DO YOUR FIGURING HERE.

16. Marcie will paint the shaded region (1 pentagonal wall) of the outside of the playhouse shown below. All given dimensions are in feet. Each 1-quart container of paint will cover 50 square feet, and only 1 coat of paint will be applied. How many 1-quart containers of paint will Marcie need in order to cover the 1 pentagonal wall of the playhouse?

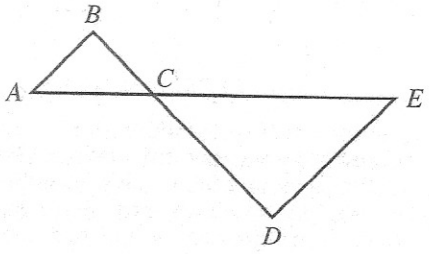


F. 1
G. 2
H. 3
J. 4
K. 5

17. A certain computer performs 1.5×10^8 calculations per second. How many seconds would it take this computer to perform 6.0×10^{16} calculations?

A. 2.5×10^{-9}
B. 9.0×10^{0}
C. 4.0×10^{2}
D. 4.0×10^{8}
E. 9.0×10^{24}

18. In the figure below, $\overline{AE}$ and $\overline{BD}$ intersect at C, and $\overline{AB} \parallel \overline{DE}$. Which of the following angles *must* have the same measure as $\angle BAC$?



F. $\angle ACB$
G. $\angle ACD$
H. $\angle BCE$
J. $\angle CDE$
K. $\angle CED$

19. In the standard (x,y) coordinate plane, the point $(2,-4)$ is the midpoint of the line segment with endpoints $(8,-8)$ and:

A. $(-4, 0)$
B. $(-4,-16)$
C. $(3, -2)$
D. $(4, 0)$
E. $(5, -6)$

20. The product of 2 positive integers is 78. The greater integer is 1 more than twice the lesser integer. What is the greater integer?

F. 6
G. 7
H. 12
J. 13
K. 19

DO YOUR FIGURING HERE.

21. A set of numbers consists of all the odd integers that are greater than 1 and less than 21. What is the probability that a number picked at random from the set will be divisible by 3 ?

A. $\frac{1}{3}$
B. $\frac{2}{3}$
C. $\frac{2}{9}$
D. $\frac{4}{9}$
E. $\frac{5}{9}$

22. Noah bowled 3 games for his bowling team. In the second game, he scored 10 points more than in the first game; in the third game, he scored 10 points more than in the second game. His average score was 230 points for the 3 games. How many points did Noah score in the *third* game?

F. 210
G. 220
H. 230
J. 240
K. 250

23. For what 2 values of x is the equation $x^2 - 5x + 6 = 0$ true?

A. −6 and 1
B. −3 and 2
C. −2 and 3
D. −1 and 6
E. 2 and 3

24. Observation of a certain bacteria colony has shown that its population of cells doubles every 3 hours. Given that the initial population of cells in this colony is about 8 million, which of the following values, in millions, would be closest to the number of cells in the bacteria colony after 15 hours?

F. 32
G. 40
H. 120
J. 128
K. 256

25. Audrey will take biology, algebra, and Spanish next year. Audrey will have 1 of the 3 teachers who teach biology, 1 of the 4 teachers who teach algebra, and 1 of the 2 teachers who teach Spanish. From among these 9 teachers, how many possibilities are there for Audrey's 3 teachers for the 3 classes?

A. 9
B. 18
C. 24
D. 72
E. 84

DO YOUR FIGURING HERE.

26. What value of x satisfies the matrix equation below?

$$2\begin{bmatrix} 4 & -1 \\ x & 3 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 11 & 1 \\ 9 & 6 \end{bmatrix}$$

F. 3.5
G. 4
H. 4.5
J. 5.5
K. 8

27. Sophia's goal this past summer was to save an average of \$5.00 per week for 10 weeks. She saved an average of \$4.00 per week for the first 9 weeks and saved \$12.00 for the 10th week. On average, how much more should Sophia have saved each week to reach her goal?

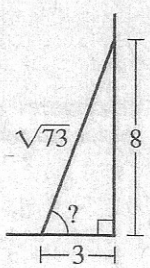
A. \$0.10
B. \$0.20
C. \$0.30
D. \$0.50
E. \$0.90

28. The rectangular deck on Sachi's house has a width of 4 yards and a length of 6 yards. Sachi remodels the deck by increasing both the length and width by the same amount. The area of her new deck is twice the area of her original deck. What is the length, in yards, of Sachi's new deck?

F. 2
G. 6
H. 8
J. 12
K. 18

29. Nestor will bury one end of a cable 3 feet from the base of an antenna and attach the other end of the cable at a point on the antenna 8 feet above the ground, as shown below. When taut, the length of the exposed cable will be $\sqrt{73}$ feet. Which of the following expressions represents the measure of the angle the taut cable will make with the level ground?

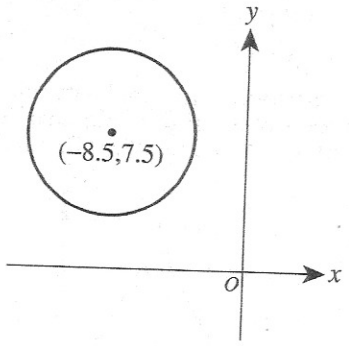
A. $\tan^{-1}\left(\frac{3}{8}\right)$
B. $\tan^{-1}\left(\frac{3}{\sqrt{73}}\right)$
C. $\tan^{-1}\left(\frac{8}{3}\right)$
D. $\tan^{-1}\left(\frac{8}{\sqrt{73}}\right)$
E. $\tan^{-1}\left(\frac{\sqrt{73}}{8}\right)$



DO YOUR FIGURING HERE.

Use the following information to answer questions 30–32.

The circle in the standard (x,y) coordinate plane below has center $(-8.5,7.5)$ and has radius 5 coordinate units.



30. Which of the following is an equation of this circle?

F. $(x - 8.5)^2 + (y + 7.5)^2 = 10$
G. $(x + 8.5)^2 + (y - 7.5)^2 = 10$
H. $(x - 8.5)^2 + (y + 7.5)^2 = 25$
J. $(x + 8.5)^2 + (y - 7.5)^2 = 25$
K. $(x + 8.5)^2 + (y + 7.5)^2 = 25$

31. What is the area, in square coordinate units, of this circle?

A. $\frac{5}{2}\pi$
B. $\frac{25}{2}\pi$
C. 10π
D. 25π
E. 100π

32. The circle will be reflected across the y-axis. What will be the coordinates of the image of the center of the circle?

F. $(-8.5,-7.5)$
G. $(-3.5,\ 2.5)$
H. $(\ 3.5,-2.5)$
J. $(\ 8.5,-7.5)$
K. $(\ 8.5,\ 7.5)$

DO YOUR FIGURING HERE.

33. In a plane, the distinct lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at A, where A is between C and D. The measure of $\angle BAC$ is 54°. What is the measure of $\angle BAD$?

A. 54°
B. $(54 + 54)°$
C. $(90 - 54)°$
D. $(90 + 54)°$
E. $(180 - 54)°$

34. For an angle with measure α in a right triangle, $\sin \alpha = \frac{180}{181}$ and $\tan \alpha = \frac{180}{19}$. What is the value of $\cos \alpha$?

F. $\frac{19}{181}$
G. $\frac{19}{180}$
H. $\frac{19}{\sqrt{65,161}}$
J. $\frac{19}{\sqrt{32,039}}$
K. $\frac{181}{19}$

35. For which of the equations below is its solution an integer?

I. $3n + 5 = 24$
II. $5n + 3 = 23$
III. $5(n + 3) = 25$

A. I only
B. II only
C. III only
D. I and II only
E. II and III only

36. Whenever x and y are nonzero, $\frac{(8x^5y^4)(6x^{13}y^3)}{16x^6y^{14}} = ?$

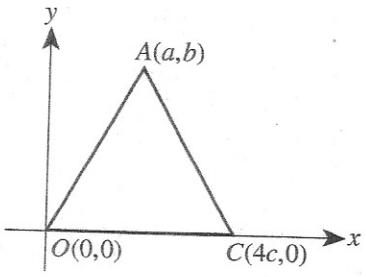
F. $3x^3y^2$
G. $\frac{3x^3}{y^2}$
H. $\frac{3x^6}{16y^{21}}$
J. $\frac{3x^{12}}{y^7}$
K. $\frac{3x^{59}}{y^2}$

DO YOUR FIGURING HERE.

37. Consider all products xy such that x is divisible by 8 and y is divisible by 14. Which of the following whole numbers is NOT a factor of each product xy ?

A. 2
B. 8
C. 12
D. 56
E. 112

38. Shown in the standard (x,y) coordinate plane below is equilateral triangle $\triangle AOC$ with coordinates $A(a,b)$, $C(4c,0)$, and $O(0,0)$. In terms of c, what is a ?



F. c
G. $2c$
H. $3c$
J. $4c$
K. $6c$

39. On Monday, Jan and Diego opened separate bank accounts with initial deposits of \$28.00 and \$161.00, respectively. Every Monday after opening the accounts, Jan will add \$18.25 to her account and Diego will withdraw \$15.00 from his account. Which of the following equations, when solved, gives the number of weeks (w) after opening the accounts that Jan and Diego will have the same amount of money in their respective accounts?

(Note: They make no other deposits or withdrawals, and no interest is applied to the money in the accounts.)

A. $-18.25w + 28 = -15w + 161$
B. $18.25w + 28 = 15w + 161$
C. $18.25w + 28 = 15w - 161$
D. $18.25w + 28 = -15w + 161$
E. $28w + 18.25 = 161w - 15$

40. Let p and q be real numbers such that $p + q = 4$, $-pq = 12$, and $p > q$. What is p ?

F. 2
G. 3
H. 4
J. 6
K. 8

DO YOUR FIGURING HERE.

41. The table below gives the weights, rounded to the nearest pound, at birth and at 1 year for 5 boys. A researcher models these weights as a linear function where the weight at 1 year is dependent on the weight at birth. Among the following models, which is best?

Name	Weight at birth (x pounds)	Weight at 1 year (y pounds)
Aiden	6	17
Clark	5	16
Graham	8	24
Johan	10	30
Owen	9	26

A. $y = 3x$
B. $y = 4x$
C. $y = x + 11$
D. $y = x + 16$
E. $y = 2x + 10$

42. In the standard (x,y) coordinate plane, what is the slope of the line that is perpendicular to the line $8x + 7y = 112$?

F. $-\frac{8}{7}$

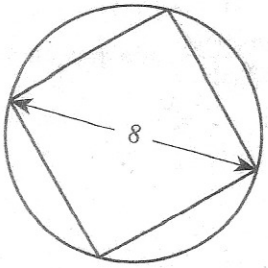
G. $-\frac{7}{8}$

H. $-\frac{1}{8}$

J. $\frac{7}{8}$

K. 8

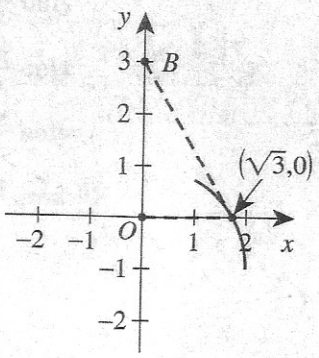
43. The circle below has a diameter of 8 centimeters. Which of the following is closest to the area, in square centimeters, of the square inscribed in the circle?



A. 25
B. 32
C. 50
D. 64
E. 201.

DO YOUR FIGURING HERE.

44. Points $O(0,0)$ and $B(0,3)$ below lie in the standard (x,y) coordinate plane. The collection of all points such that each is twice as far from B as from O forms a circle. The point $(\sqrt{3},0)$ is 1 point on the circle. What are the coordinates of the center of that circle?



F. $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$

G. $\left(0, \frac{3}{2}\right)$

H. $(0, 1)$

J. $(0,-1)$

K. $(0,-3)$

45. Given $\frac{3}{x} = 12$ and $\frac{x}{y} = 2$, what is the value of y ?

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. 8

E. 18

46. Temperatures measured in degrees Fahrenheit (F) are related to temperatures measured in degrees Celsius (C) by the formula $F = \frac{9}{5}C + 32$. There is 1 value of x for which x degrees Fahrenheit equals x degrees Celsius. What is that value?

F. –72
G. –40
H. –32
J. 0
K. 32

DO YOUR FIGURING HERE.

47. The domain of $f(x) = \frac{2}{x^3 - 9x}$ is the set of all real numbers EXCEPT:

A. $-\frac{2}{9}$

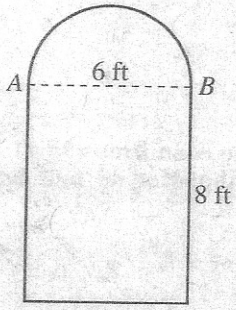
B. 3

C. −3 and 3

D. 0 and 3

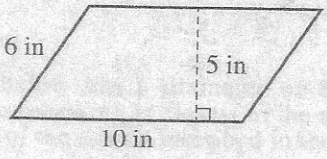
E. −3, 0, and 3

48. The figure shown below is composed of a rectangle and a semicircle. Points A and B are endpoints of both a side of the rectangle and a diameter of the semicircle. What is the perimeter, in feet, of the figure?



F. $3\pi + 20$
G. $3\pi + 22$
H. $6\pi + 14$
J. $6\pi + 28$
K. $9\pi + 48$

49. What is the area, in square inches, of the parallelogram shown below?



A. 42
B. 50
C. 55
D. 60
E. 75

50. What is the sixth term of the geometric sequence whose second term is −4 and whose fifth term is 32 ?

F. −128
G. −64
H. 44
J. 128
K. 256

51. What are the values of θ, between 0 and 2π, when $\tan\theta = -1$?

DO YOUR FIGURING HERE.

A. $\frac{\pi}{4}$ and $\frac{3\pi}{4}$ only

B. $\frac{3\pi}{4}$ and $\frac{5\pi}{4}$ only

C. $\frac{3\pi}{4}$ and $\frac{7\pi}{4}$ only

D. $\frac{5\pi}{4}$ and $\frac{7\pi}{4}$ only

E. $\frac{\pi}{4}$, $\frac{3\pi}{4}$, $\frac{5\pi}{4}$, and $\frac{7\pi}{4}$

52. A can of soda pop has the shape of a right circular cylinder with an inside height of 6 inches and an inside diameter of 2 inches. When you pour the soda pop from the full can into a cylindrical glass with an inside diameter of 3 inches, about how many inches high is the soda pop in the glass?

(Note: The volume of a right circular cylinder is $\pi r^2 h$.)

F. $2\frac{2}{3}$

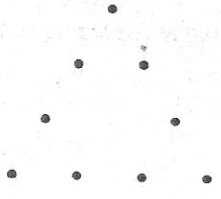
G. 4

H. 5

J. $6\frac{2}{3}$

K. 8

53. Suppose that equally spaced dots are marked on each side of a regular polygon, with a dot at each vertex, and that the distance between consecutive dots is the same for all sides. The figure below shows 4 equally spaced dots per side, including a dot at each vertex, for an equilateral triangle. Which of the following expressions represents the number of dots for a regular polygon with n equally spaced dots, including one at each vertex, marked on each of its s sides?



A. ns
B. $ns - 1$
C. $ns - s$
D. $ns + s$
E. $ns - n$

DO YOUR FIGURING HERE.

Use the following information to answer questions 54–56.

A storage facility is currently offering a special rate to customers who sign contracts for 6 months or more. According to this special rate, the first month's rent is \$1, and for each month after the first month, customers pay the regular monthly rental rate. The table below shows the storage unit sizes available, the floor dimensions, and the regular monthly rental rate. All the units have the same height.

Size	Floor dimensions, in meters	Regular monthly rental rate
1	2 × 4	\$ 30
2	4 × 4	\$ 60
3	4 × 8	\$100
4	8 × 8	\$150
5	8 × 16	\$200

54. Daria will sign a contract to rent a Size 3 unit for 12 months at the current special rate. The amount Daria will pay for 12 months at the current special rate represents what percent decrease from the regular rental rate for 12 months?

F. 8.25%
G. 8.33%
H. 8.42%
J. 9.00%
K. 9.09%

55. Size 5 units can be subdivided to form other sizes of units. What is the greatest number of Size 1 units that can be formed from a single Size 5 unit?

A. 2
B. 4
C. 8
D. 10
E. 16

56. Janelle, the owner of the storage facility, is considering building new units that have floor dimensions larger than Size 5 units. She will use the floor area to determine the heating requirements of these larger units. For this calculation, Janelle will use the same relationship between the unit size number and the respective floor area for Sizes 1 through 5. Which of the following expressions gives the floor area, in square meters, of a Size x storage unit?

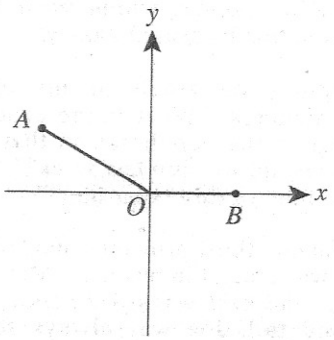
F. $2^3 \cdot x$
G. 2^{3x}
H. $2^{(2+x)}$
J. $2(x+1)^2$
K. $(x+2)^2$

DO YOUR FIGURING HERE.

57. For how many integers x is the equation $3^{x+1} = 9^{x-2}$ true?

A. 0
B. 1
C. 2
D. 3
E. An infinite number

58. In the standard (x,y) coordinate plane below, B is on the positive x-axis, the measure of $\angle AOB$ is 150°, and the length of $\overline{AO}$ is 1 coordinate unit. What are the coordinates of A ?



F. $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
G. $\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
H. $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
J. $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
K. $\left(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

59. Which of the following polar coordinates represents the same location as $(3, 45°)$?

A. $(3, -315°)$
B. $(3, -225°)$
C. $(3, -45°)$
D. $(3, 135°)$
E. $(3, 315°)$

60. The equation $y = \frac{2x^2 - 18}{x^2 - 5x}$ has 2 vertical asymptotes and 1 horizontal asymptote. What is the horizontal asymptote?

F. $x = 0$
G. $x = 3$
H. $x = 9$
J. $y = 0$
K. $y = 2$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.