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MATHEMATICS TEST

60 Minutes – 60 Questions

DIRECTIONS: Solve each of the problems in the time allowed, then fill in the corresponding bubble on your answer sheet. Do not spend too much time on any one problem; skip the more difficult problems and go back to them later. You may use a calculator on this test. For this test you should assume that figures are NOT necessarily drawn to scale, that all geometric figures lie in a plane, and that the word *line* is used to indicate a straight line.

DO YOUR FIGURING HERE.

1. If $4x - 9 = 11$, then $x = ?$
   - A. 5
   - B. 6
   - C. 6.5
   - D. 9
   - E. 16

2. Consider the following 2 logical statements:

   If the length of $\overline{XY}$ is 4, then the length of $\overline{YZ}$ is 7.
   The length of $\overline{YZ}$ is NOT 7.
   If these statements are both true, then the length of:

   - F. $\overline{XY}$ is NOT 4
   - G. $\overline{XY}$ is 7
   - H. $\overline{YZ}$ is 4
   - J. $\overline{YZ}$ is NOT 4
   - K. $\overline{YZ}$ is 7

3. If 60% of a given number is 9, then what is 25% of the given number?
   - A. 0.66
   - B. 1.75
   - C. 2.33
   - D. 3.75
   - E. 6.50

4. Vehicle A averages 16 miles per gallon of gasoline, and Vehicle B averages 35 miles per gallon of gasoline. At these rates, how many more gallons of gasoline does Vehicle A need than Vehicle B to make a 1,120-mile trip?
   - F. 32
   - G. 38
   - H. 46
   - J. 63
   - K. 70

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5. The five consecutive integers below add up to 390.

$x-3$
$x-2$
$x-1$
x
$x+1$

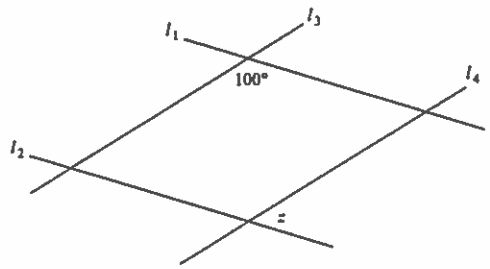
What is the value of x?

A. 79
B. 80
C. 81
D. 82
E. 83

6. If $P=5a$ and $Q=3b-2a$, then what is the value of $P-Q$?

F. $7a+3b$
G. $3a+3b$
H. $7a-3b$
J. $3a-3b$
K. $5a-3b$

7. In the figure below, l_1 is parallel to l_2, l_3 is parallel to l_4, and the lines intersect as shown. What is the measure of angle z?



A. 40°
B. 50°
C. 60°
D. 70°
E. 80°

8. If $x=2$, then $-(x^2)+4x-3=?$

F. 9
G. 5
H. 1
J. −1
K. −7

9. The average of 8 numbers is 6.5. If each of the numbers is decreased by 3, what is the average of the 8 new numbers?

A. 0.0
B. 3.5
C. 4.0
D. 7.5
E. 9.5

10. The expression $5a+5b$ is equivalent to which of the following?

F. $5(a-b)$
G. $10(a+b)$
H. $5ab$
J. $5(a+b)$
K. $10ab$

DO YOUR FIGURING HERE.

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DO YOUR FIGURING HERE.

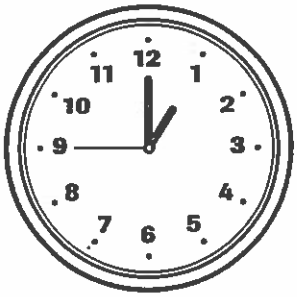
11. An interior designer charges \$25 for each hour that she works on a project, plus a flat \$40 project fee. Approximately how many hours of work are included in a \$375 bill for a project?

A. 4.5
B. 5.8
C. 9.4
D. 13.4
E. 15.0

12. If $\frac{8}{x} \geq \frac{1}{4}$, what is the largest possible value for x?

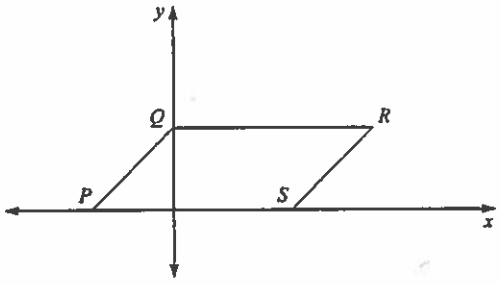
F. $\frac{1}{2}$
G. 4
H. 16
J. 24
K. 32

13. On the clock shown below, what is the number of degrees that the hour hand of the clock moves from 1:00 P.M. to 8:00 P.M.?



A. 70°
B. 150°
C. 210°
D. 270°
E. 300°

14. In the standard (x, y) coordinate plane below, $PQRS$ is a parallelogram. Points P, Q, and S are located on the axes as shown. Which of the following could be the coordinates of point R?



F. (0, 4)
G. (4, 0)
H. (−3, 0)
J. (6, 4)
K. (6, −4)

GO ON TO THE NEXT PAGE.

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DO YOUR FIGURING HERE.

15. Which of the following is a factored form of $3x^3y^3 + 3xy$?
    A. $3xy(x^2y^2 + 1)$
    B. $3(3x^2y^2)$
    C. $(3x + 3y)(3x + 3y)$
    D. $3x^2y^2(xy)$
    E. $3x(x^2y^2 + 3)$

16. A classroom has $(r + s)$ rows of seats and t seats in each row. Which of the following is an expression for the number of seats in the entire classroom?
    F. rst
    G. $(rs) + (rt)$
    H. $t + (rs)$
    J. $r + s + t$
    K. $(rt) + (st)$

17. If 20% of x equals 16, then $x =$?
    A. 2
    B. 3.2
    C. 32
    D. 80
    E. 800

18. In a 5-kilometer race, runners recorded times (in minutes:seconds) of 24:04, 22:45, 19:53, and 21:33. What is the difference between the slowest time and the fastest time?
    F. 2:23
    G. 2:45
    H. 4:11
    J. 4:51
    K. 5:38

19. You are standing in line at the cash register to pay for a watch priced at $12.99. A sales tax of 6% of the $12.99 will be added (rounded to the nearest cent) to the price of the watch. You have 15 one-dollar bills, but how much will you need in coins if you want to have exact change ready?
    A. $0.23
    B. $0.33
    C. $0.53
    D. $0.67
    E. $0.77

20. For which nonnegative value of x is the expression $\frac{1}{16 - x^2}$ undefined?
    F. 0
    G. 4
    H. 16
    J. 32
    K. 256

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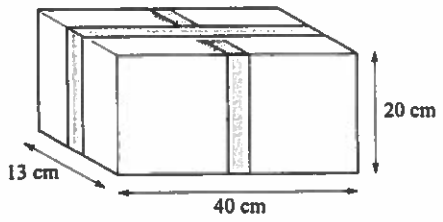
21. What is the smallest integer greater than $\sqrt{99}$?

A. 3
B. 9
C. 10
D. 11
E. 50

DO YOUR FIGURING HERE.

22. Two strips of tape are to be used to seal a box, as shown below. Both strips must go completely around the box. What is the minimum length of tape, in centimeters (cm), required to seal the box?



F. 73 cm
G. 112 cm
H. 120 cm
J. 146 cm
K. 186 cm

23. Kahla owns 2 bicycle shops (A and B). She stocks 3 brands of biking shorts (X, Y, and Z) in each store. The matrices below show the numbers of each type of biking shorts in each store and the cost for each type of biking short. The value of Kahla's biking short inventory is computed using the costs listed. What is the total value of the biking short inventory for Kahla's 2 stores?

$$\begin{array}{c} \\ A \\ B \end{array}\begin{array}{c} \begin{array}{ccc} X & Y & Z \end{array} \\ \begin{pmatrix} 150 & 200 & 225 \\ 100 & 120 & 175 \end{pmatrix} \end{array} \qquad \begin{array}{c} \text{Cost} \\ \begin{array}{c} X \\ Y \\ Z \end{array}\begin{pmatrix} \$20 \\ \$25 \\ \$30 \end{pmatrix} \end{array}$$

A. $25,000
B. $20,000
C. $13,000
D. $14,750
E. $10,250

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DO YOUR FIGURING HERE.

24. Which of the following gives all the solutions of $x^2+2x=8$?

F. 4 and -2
G. -4 and 2
H. -8 and 1
J. -4 only
K. -8 only

25. If $(f+g)^2=81$ and $fg=20$, then $f^2+g^2=?$

A. 1
B. 9
C. 41
D. 81
E. 100

26. If, for all x, $(x^{4a-3})^2 = x^{10}$, then $a=?$

F. $\frac{1}{2}$
G. 1
H. $\frac{13}{4}$
J. 2
K. $-\frac{15}{6}$

27. For the complex number i such that $i^2 = -1$, what is the value of $i^6 + 3i^4$?

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

28. In the (x, y) coordinate plane, what is the y-intercept of the line $5x-4y=7$?

F. -4
G. $-\frac{7}{4}$
H. $\frac{5}{4}$
J. $\frac{7}{4}$
K. 7

29. In the (x, y) coordinate plane, what is the radius of the circle with the equation $(x+3)^2+(y-2)^2 = 10$?

A. 2
B. 3
C. $\sqrt{3}$
D. $\sqrt{10}$
E. 10

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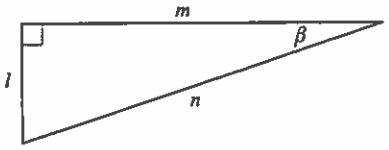
DO YOUR FIGURING HERE.

30. In the right triangle pictured below, l, m, and n are the lengths of its sides. What is the value of $\sin \beta$?

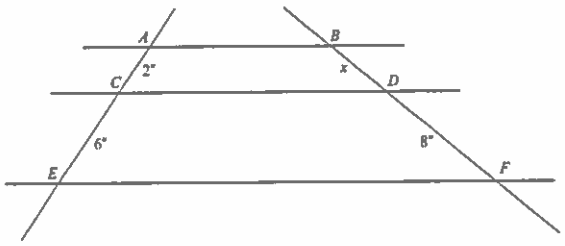


F. $\frac{l}{n}$
G. $\frac{m}{n}$
H. $\frac{n}{l}$
J. $\frac{l}{m}$
K. $\frac{n}{m}$

31. For all nonzero a and b, $\frac{(4a^3b)(-5a^5b^3)}{(10a^4b^2)} = ?$

A. $2a^4b^2$
B. $-2a^2b^2$
C. $\frac{a^4b^4}{2}$
D. $\frac{9}{b}$
E. $-2a^4b^2$

32. In the figure below, 3 parallel lines are crossed by 2 transversals, as shown. The points of intersection and some distances, in inches, are labeled. What is the length, in inches, of x?



F. 2
G. $\frac{8}{3}$
H. 3
J. $\frac{4}{3}$
K. 4

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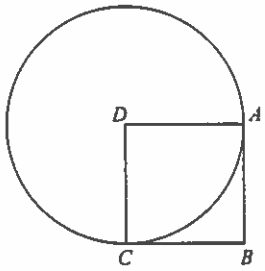
DO YOUR FIGURING HERE.

33. The figure below shows square $ABCD$ and also shows the circle centered at D with radii $\overline{DC}$ and $\overline{DA}$. If the perimeter of the square is 28 units, what is the area of the circle, in square units?

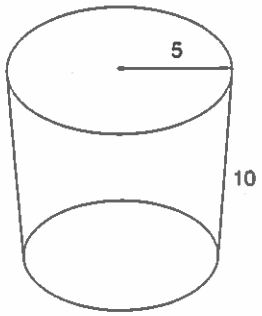


A. 7π
B. 14π
C. 28π
D. 49π
E. 56π

34. Which of the following logical statements identifies the same set as the graph shown below?

F. $x \leq 2$ or $x \geq 4$
G. $x \leq 2$ and $x \geq 4$
H. $x < 2$ or $x > 4$
J. $x \leq 2$ and $x > 4$
K. $x \leq 2$ or $x > 4$

35. A right circular cylinder is shown below, with dimensions given in inches. What is the total surface area of this cylinder, in square inches?
(Note: The total surface area of a cylinder is given by $2\pi r^2 + 2\pi rh$, where r is the radius and h is the height.)



A. 50π
B. 100π
C. 120π
D. 150π
E. 200π

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36. If x and y are real and $\sqrt{4\left(\frac{x^2}{3y}\right)} = 1$, then what must be true of the value of y?

F. y must be negative
G. y must be positive
H. y must equal 4
J. y must equal $\frac{1}{2}$
K. y may have any value

DO YOUR FIGURING HERE.

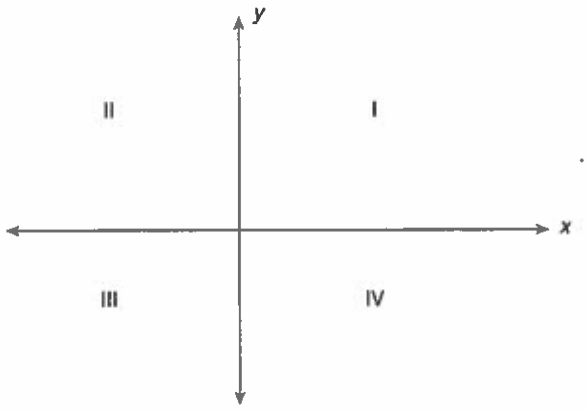
37. If c is a positive integer that divides evenly into both 64 and 96 but divides evenly into neither 16 nor 20, what should you get when you add the digits in c?

A. 3
B. 5
C. 7
D. 8
E. 10

38. What is the slope of any line parallel to the y-axis in the (x, y) coordinate plane?

F. -1
G. 0
H. 1
J. Undefined
K. Cannot be determined from the given information

39. If point J has a nonzero x-coordinate and a nonzero y-coordinate and the coordinates have the same sign, then point J *must* be located in which of the 4 quadrants shown below?



A. I only
B. II only
C. III only
D. I or III only
E. II or IV only

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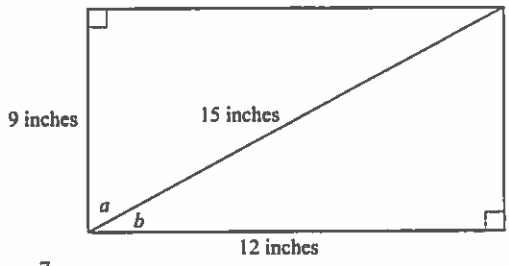
DO YOUR FIGURING HERE.

40. The 2 triangles in the rectangle below share a common side. What is $\sin(a-b)$?
(Note: $\sin(a-b)=\sin a\cos b-\cos a\sin b$ for all a and b.)



F. $\frac{7}{25}$
G. $\frac{1}{2}$
H. $\frac{3}{5}$
J. 1
K. $\frac{25}{9}$

41. Which of the following represents 1/100 of 10%?

A. 1.0
B. 0.1
C. 0.01
D. 0.001
E. 0.00

42. Which of the following calculations will yield an odd integer for any integer n?

F. $4n^2$
G. $3n^2+1$
H. $6n^2$
J. n^2-1
K. $4n^2-1$

43. In triangle ABC, the measure of $\angle A$ is 60° and the measure of $\angle B$ is 30°. If $\overline{AB}$ is 8 units long, what is the area, in square units, of triangle ABC?

A. 4
B. $4\sqrt{3}$
C. 8
D. $8\sqrt{3}$
E. $16\sqrt{3}$

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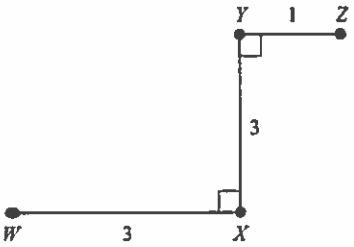
DO YOUR FIGURING HERE.

44. In the figure below, all distances are in feet and all angles are right angles. A straight line drawn from point W to point Z would be how long, in feet?



F. 1.5
G. 2
H. 4.66
J. 5
K. 7.23

45. A certain rectangle is 4 times as long as it is wide. Suppose the length and width are tripled. The area of the second rectangle is how many times as large as the area of the first?

A. 3
B. 4
C. 9
D. 12
E. 16

46. For what value of b would the following system of equations have an infinite number of solutions?

$$3x + 4y = 14$$
$$6x + 8y = 7b$$

F. 2
G. 4
H. 7
J. 14
K. 28

47. If $\log_3 x = 2$, then $x = ?$

A. $\frac{1}{\log_9}$
B. 3
C. 6
D. 9
E. 18^2

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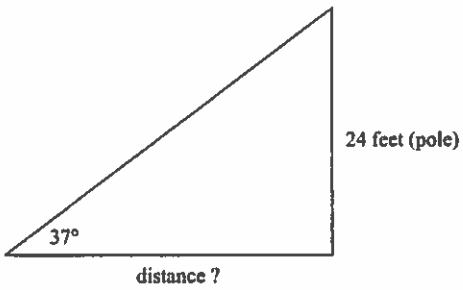
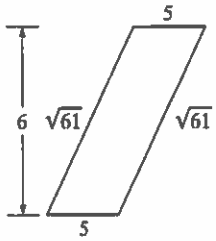
48. When measured from a point on the ground that is a certain distance from the base of a telephone pole, the angle of elevation to the top of the telephone pole is 37°, as shown below. The height of the telephone pole is 24 feet. What is the distance, in feet, to the telephone pole?



F. 24 tan 37°
G. 24 sin 37°
H. 24 cos 37°
J. 24 sec 37°
K. 24 cot 37°

DO YOUR FIGURING HERE.

49. In the parallelogram below, lengths are given in inches. What is the area of the parallelogram, in square inches?



A. 15
B. $\sqrt{61}$
C. 30
D. $\sqrt{122}$
E. $2\sqrt{61}$

50. Points A, B, and C are 3 distinct points that lie on the same line. If the length of $\overline{AB}$ is 12 meters and the length of $\overline{BC}$ is 15 meters, then what are all the possible lengths, in meters, for $\overline{AC}$?

F. 3 only
G. 27 only
H. 3 and 27 only
J. Any number less than 27 or greater than 3
K. Any number greater than 27 or less than 3

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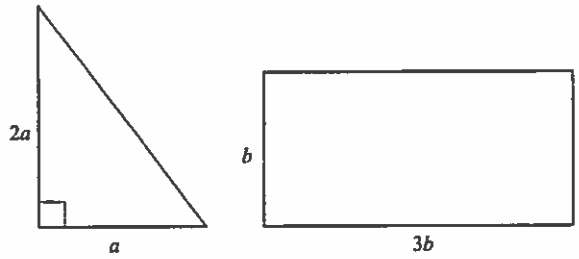
DO YOUR FIGURING HERE.

51. If the right triangle and the rectangle in the figure below have the same area, and indicated lengths are given in centimeters, what is a expressed in terms of b?



A. b
B. $b\sqrt{3}$
C. $b\sqrt{4.5}$
D. $b\sqrt{5}$
E. $b\sqrt{6}$

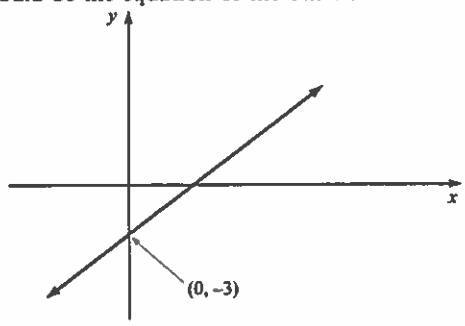
52. If $6a^4b^3 < 0$, then which of the following CANNOT be true?

F. $b < 0$
G. $b > 0$
H. $a = b$
J. $a < 0$
K. $a > 0$

53. The 1st and 2nd terms of a geometric sequence are p and sp, in that order. What is the 734th term of the sequence?

A. $(sp)^{733}$
B. $(sp)^{734}$
C. $s^{733}p$
D. $s^{734}p$
E. sp^{733}

54. If a system of 2 linear equations in 2 variables has NO solution, and 1 of the equations is graphed in the (x, y) coordinate plane below, which of the following could be the equation of the other line?



F. $y = -2$
G. $y = -4x + 2$
H. $y = -2x - 3$
J. $y = 4x + 2$
K. $y = 4x - 3$

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55. If $0° \leq x \leq 90°$ and $\tan x = \frac{15}{8}$, then $\cos x = ?$

DO YOUR FIGURING HERE.

A. $\frac{8}{17}$
B. $\frac{15}{17}$
C. $\frac{17}{8}$
D. $\frac{17}{15}$
E. $\frac{8}{15}$

56. If L, M, and N are real numbers, and if $LMN = 1$, which of the following conditions *must* be true?

F. $LM = \frac{1}{N}$
G. L, M, and N must all be positive
H. Either $L = 1$, $M = 1$, or $N = 1$
J. Either $L = 0$, $M = 0$, or $N = 0$
K. Either $L < 1$, $M < 1$, or $N < 1$

57. Which of the following is a rational number?

A. $\frac{\sqrt{1}}{\sqrt{2}}$
B. $\sqrt{2}$
C. $\sqrt{5}$
D. $\frac{\sqrt{81}}{\sqrt{169}}$
E. $\sqrt{200}$

58. In order to clean her aquarium, Rana must remove half of the water. The aquarium measures 24 inches long, 12 inches wide, and 10 inches deep. The aquarium is currently completely full. What volume of water, in cubic inches, must Rana remove?

F. 288
G. 960
H. 1,440
J. 2,880
K. 5,760

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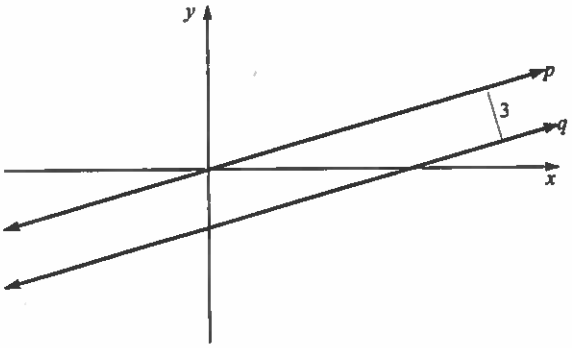
59. In the figure below, line p has the equation $y=3x$. Line q is below p, as shown, and q is parallel to p. Which of the following is an equation for q?



A. $y=x-3$
B. $y=3x-3\sqrt{2}$
C. $y=x-3\sqrt{2}$
D. $y=3x-3$
E. $y=3x+3$

60. What is the smallest possible value for the product of 2 real numbers that differ by 12?

F. -36
G. -27
H. -11
J. 0
K. 13

DO YOUR FIGURING HERE.

END OF THE MATHEMATICS TEST

STOP! IF YOU HAVE TIME LEFT OVER, CHECK YOUR WORK ON THIS SECTION ONLY.