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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. In the standard (x,y) coordinate plane, point X has coordinates $(-4,0)$ and point Y has coordinates $(0,-8)$. What are the coordinates of the midpoint of $\overline{XY}$?
    A. $(-6,-1)$
    B. $(-2,-4)$
    C. $(0,2)$
    D. $(2,4)$
    E. $(6,-1)$

2. Given right triangle $\triangle MNO$ below, how many units long is $\overline{NO}$?

    F. $2\sqrt{2}$
    G. 4
    H. 6
    J. $\sqrt{60}$
    K. 8
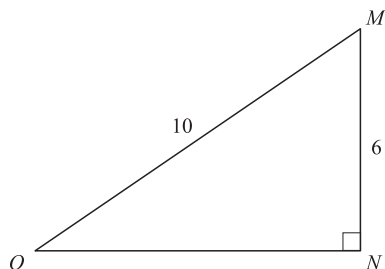
3. A distance in meters, M, can be approximated by multiplying a distance in yards, Y, by 1.0936. Which of the following expresses this approximation method? (Note: The symbol $\approx$ means "is approximately equal to.")
    A. $M \approx \dfrac{Y}{1.0936}$

    B. $M \approx \dfrac{1.0936}{Y}$

    C. $M \approx Y(1.0936)$
    D. $M \approx Y + 1.0936$
   E. $M \approx Y(1.0936Y)$

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4. Seth has 4 plaid shirts and 5 solid-colored shirts hanging together in a closet. In his haste to get ready for work, he randomly grabs 1 of these 9 shirts. What is the probability that the shirt Seth grabs is plaid?

F. $\dfrac{1}{5}$

G. $\dfrac{1}{4}$

H. $\dfrac{4}{9}$

J. $\dfrac{1}{9}$

K. $\dfrac{4}{5}$

5. The daily totals of enrollments at Sunnyside Summer Camp last Monday through Saturday were 17, 19, 23, 14, 25, and 28. What was the average number of enrollments per day?

A. 126
B. 28
C. 21
D. 18
E. 14

6. In the figure showing $\triangle PQR$ below, line l is parallel to line m. Which one of the following angles must be congruent to $\angle y$?
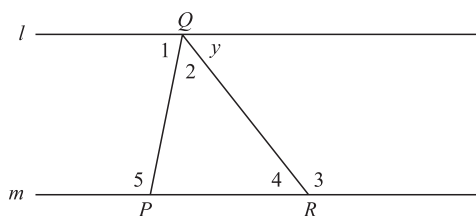
F. $\angle 1$
G. $\angle 2$
H. $\angle 3$
J. $\angle 4$
K. $\angle 5$

7. A carton of paper is priced at $27.00 now. If the paper goes on sale for 25% off the current price, what will be the sale price of the carton?

A. $6.75
B. $20.25
C. $22.00
D. $26.75
E. $33.75

DO YOUR FIGURING HERE.

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DO YOUR FIGURING HERE.

8. What is the slope of any line parallel to the line $2x - 3y = 7$?

  F. -3

  G. $-\dfrac{2}{3}$

  H. $\dfrac{2}{3}$

  J. 2
  K. 3

9. Andrew won a cash prize on a game show. Andrew paid taxes of 30% on the original cash prize and had \$28,000 remaining. How much was the original cash prize?

  A. \$19,600
  B. \$28,300
  C. \$36,400
  D. \$40,000
  E. \$84,000

10. Melissa had 3 fewer apples than Marcia. Then, she gave 2 apples to Marcia. Now how many fewer apples does Melissa have than Marcia?

  F. 0
  G. 2
  H. 3
  J. 5
  K. 7

11. What is the value of $|5 - a|$ if $a = 9$?

  A. -14
  B. -4
  C. 4
  D. 9
  E. 14

12. For all m and n, $(3m + n)(m^2 - n) = ?$

  F. $3m^3 + 2m^2 - 2n$
  G. $m^3 - 2n^2$
  H. $2m^2 - n - n^2$
  J. $3m^2 + 3mn - 2n^2$
  K. $3m^3 - 3mn + m^2n - n^2$

13. For all x, $13 - 2(x + 5) = ?$

  A. $-2x + 3$
  B. $11x + 55$
  C. $13 + 10x$
  D. $23 - 2x$
  E. $23 + 2x$

14. $(n^7)^{11}$ is equivalent to:

  F. n^{77}
  G. n^{18}
  H. $11n^4$
  J. $11n^7$
  K. $77n$

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15. What is the 217th digit after the decimal point in the repeating decimal $0.\overline{3456}$?

  A. 0
  B. 3
  C. 4
  D. 5
  E. 6

16. The perimeter of a square is 48 centimeters. What is its area, in square centimeters?

  F. 12
  G. 96
  H. 144
  J. 192
  K. 2,304

17. What is the product of the 2 solutions of the equation $x^2 + 3x - 21 = 0$?

  A. -63
  B. -21
  C. -20
  D. 20
  E. 21

18. Which of the following expressions is a polynomial factor of $a^{16} - 16$?

  F. $a^4 - 4$
  G. $a^4 + 4$
  H. $a^4 + 2$
  J. $a + 2$
  K. $a - 2$

19. When $n = \dfrac{1}{4}$, what is the value of $\dfrac{2n - 5}{n}$?

  A. 18
  B. 9
  C. -3
  D. -9
  E. -18

20. A proofreader can read 40 pages in one hour. How many pages can this proofreader read in 90 minutes?

  F. 45
  G. 60
  H. 150
  J. 360
  K. 940

DO YOUR FIGURING HERE.

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21. The area of a parallelogram may be found by multiplying the base by the height. What is the area, in square inches, of the parallelogram below?
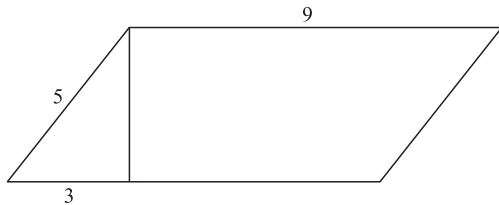
A. 27
B. 36
C. 45
D. 48
E. 81

22. For a certain quadratic equation, $ax^2 + bx + c = 0$, the 2 solutions are $x = \dfrac{3}{4}$ and $x = -\dfrac{2}{5}$. Which of the following could be factors of $ax^2 + bx + c$?

F. $(4x - 3)$ AND $(5x + 2)$
G. $(4x - 2)$ AND $(5x + 3)$
H. $(4x + 2)$ AND $(5x - 3)$
J. $(4x + 3)$ AND $(5x - 2)$
K. $(4x + 3)$ AND $(5x + 2)$

23. All sides of a rhombus are the same length, as shown below.
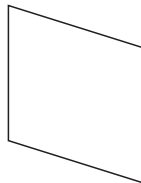
If one diagonal is 12 inches long and the other is 32 inches long, how many inches long, to the nearest hundredth of an inch, is a side of the rhombus?
A. 8.54
B. 17.09
C. 34.17
D. 35.78
E. 48.00

24. A rectangular parking lot that is 3 feet longer than it is wide has an area of 550 square feet. How many feet long is the parking lot?
F. 19
G. 20
H. 22
J. 25
K. 28

DO YOUR FIGURING HERE.

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25. In the standard (x, y) coordinate plane, what is the slope of the line joining the points $(3, 7)$ and $(4, -8)$?

A. -15

B. -1

C. $-\dfrac{1}{7}$

D. $\dfrac{21}{32}$

E. 15

26. Which of the following is the solution set of $x + 2 > -4$?
F. $\{x : x < -6\}$
G. $\{x : x > -6\}$
H. $\{x : x < -2\}$
J. $\{x : x > 2\}$
K. $\{x : x < 6\}$

27. What is the center of the circle with equation $(x - 3)^2 + (y + 3)^2 = 4$ in the standard (x, y) coordinate plane?
A. $(3, 3)$
B. $(3, -3)$
C. $(\sqrt{3}, -\sqrt{3})$
D. $(-3, 3)$
E. $(-\sqrt{3}, \sqrt{3})$

28. In the standard (x, y) coordinate plane, what is the length of the line segment that has endpoints $(-3, 4)$ and $(5, -6)$?
F. 9
G. $2\sqrt{41}$
H. 18
J. $20\sqrt{2}$
K. 40

29. A triangle has sides of length 4.7 meters and 9 meters. Which of the following CANNOT be the length of the third side, in meters?
A. 5
B. 7
C. 8
D. 11
E. 14

30. If $\dfrac{n^x}{n^y} = n^2$ for all $n \neq 0$, which of the following must be true?
F. $x + y = 2$
G. $x - y = 2$
H. $x \times y = 2$
J. $x \div y = 2$
K. $\sqrt{xy} = 2$

DO YOUR FIGURING HERE.

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31. In the standard (x, y) coordinate plane, what is the y-intercept of the line given by the equation $3x + 5y = 8$?

A. 3

B. $\dfrac{5}{3}$

C. $\dfrac{8}{5}$

D. $-\dfrac{3}{5}$

E. -3

32. There are 16 ounces in one pound. If 3.4 pounds of beef cost \$4.95, what is the cost per ounce, to the nearest cent?

F. \$0.09
G. \$0.31
H. \$1.05
J. \$1.46
K. \$10.99

33. $\left(\dfrac{1}{2}\right)^2 + \left(\dfrac{1}{3}\right)^2 + \left(\dfrac{1}{4}\right)^2 = ?$

A. $\dfrac{1}{29}$

B. $\dfrac{3}{29}$

C. $\dfrac{61}{144}$

D. $\dfrac{15}{32}$

E. 9

34. One route along flat terrain from Hermansville to Melville is to drive straight north from Hermansville for 120 miles to Jamestown, then, at Jamestown, to drive straight west for 80 miles to Melville. If a straight, flat road existed between Hermansville and Melville, approximately how many miles long would it be?

F. 200
G. 144
H. 100
J. 98
K. 40

35. In order to clean her aquarium, Stephanie must remove half of the water. The aquarium measures 30 inches long, 16 inches wide, and 12 inches deep. The aquarium is currently completely full. What volume of water, in cubic inches, must Stephanie remove?

A. 1,440
B. 2,880
C. 4,320
D. 5,760
E. 7,200

DO YOUR FIGURING HERE.

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36. The bowling league selects its 4 officers by first selecting the president, then the vice president, then the secretary, then the treasurer. If there are 40 bowlers who are eligible to hold office and no member can hold more than one office, which of the following gives the number of different possible results of the election?

F. 37^4
G. 39^4
H. 40^4
J. $39 \times 38 \times 37 \times 36$
K. $40 \times 39 \times 38 \times 37$

37. The points R (2,2) and S (6,3) in the standard (x,y) coordinate plane below are 2 vertices of triangle RST, which has a right angle at S. Which of the following could be the third vertex, T?
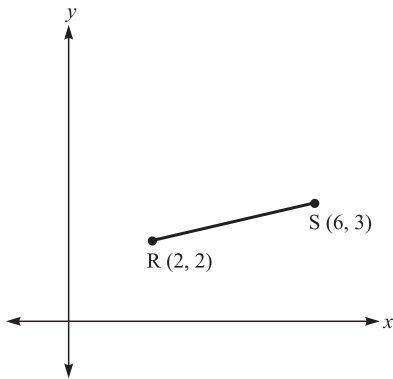
A. (5,7)
B. (5,−5)
C. (4,6)
D. (4,9)
E. $\left(4, \dfrac{9}{2}\right)$

38. What value of x will satisfy the equation $0.2(x - 2{,}700) = x$?

F. −675
G. −540
H. 0
J. 540
K. 675

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

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

DO YOUR FIGURING HERE.

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40. A square pool with an area of 81 square feet is to be placed entirely within a circular enclosure with a radius of 10 feet. Tiles will be laid within the entire enclosure around the pool (but not under it). What is the approximate area, in square feet, of the enclosure that will be tiled?

F. 81
G. 233
H. 315
J. 396
K. Cannot be determined without knowing the exact placement of the pool.

41. In the standard (x,y) coordinate plane, which of the following lines goes through $(3,4)$ and is parallel to $y = 2x + 2$?

A. $y = \dfrac{1}{2}x + 2$

B. $y = 2x - 2$
C. $y = 2x + 4$
D. $y = 2x + 10$
E. $y = 3x + 2$

42. In the figure below, $\tan \varphi = ?$
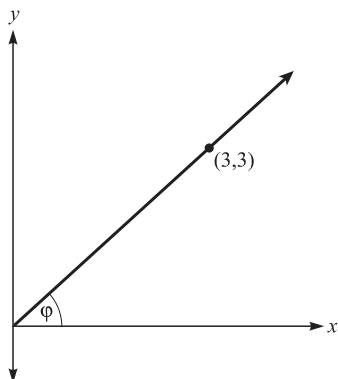
F. $\dfrac{1}{\sqrt{2}}$

G. $\sqrt{2}$
H. 1
J. 3
K. $3\sqrt{2}$

43. Which of the following operations will produce the smallest result when substituted for the blank in the expression: $\dfrac{2}{3}$ _____ $- 3$?

A. plus
B. minus
C. multiplied by
D. divided by
E. averaged with

DO YOUR FIGURING HERE.

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44. The value of b that will make $\dfrac{b}{3}+2 = \dfrac{1}{4}$ a true statement lies between which of the following numbers?
  F. -4 and -6
 **G.** -1 and -3
  H. -1 and 1
  J. 1 and 3
  K. 3 and 5

45. What is the solution set of $|3a - 2| \leq 7$?
  A. $\{a\colon a \leq 3\}$

  B. $\left\{a\colon -\dfrac{5}{3} \leq a \leq 3\right\}$

  C. $\left\{a\colon -\dfrac{5}{3} \geq a \geq 3\right\}$

  D. $\left\{a\colon -\dfrac{5}{3} \leq a \geq 3\right\}$

  E. $\left\{a\colon -\dfrac{5}{3} \geq a \leq 3\right\}$

46. When measured from a point on the ground that is a certain distance from the base of a cell phone tower, the angle of elevation to the top of the tower is 41°, as shown below. The height of the cell phone tower is 200 feet. What is the distance, in feet, to the cell phone tower?

200 ft
(tower)

41°

Distance (?)
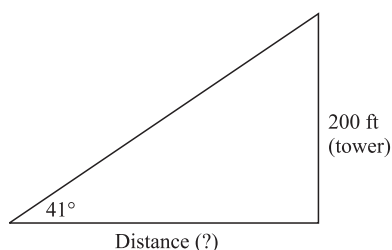
  F. $200\ \tan 41°$
  G. $200\ \sin 41°$
  H. $200\ \cos 41°$
  J. $200\ \sec 41°$
  K. $200\ \cot 41°$

47. For the area of a square to triple, the new side lengths must be the length of the old sides multiplied by:
  A. $\sqrt{3}$
  B. 3
  C. 4
  D. $2\sqrt{3}$
  E. 9

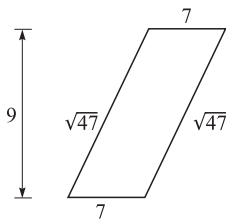**GO ON TO THE NEXT PAGE.**

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48. The volume of a cube is given by the formula s^3, where s is the length of a side. If a cube has a volume of 64, and the length of each side is halved, the new cube's volume will be:

 F. 3
 G. 6
 H. 8
 J. 16
 K. 32

DO YOUR FIGURING HERE.

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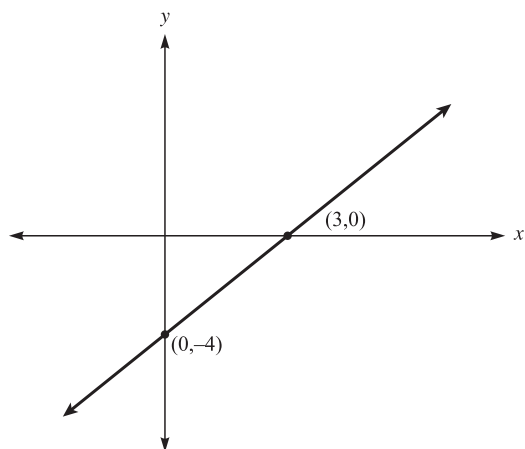

 A. $\sqrt{94}$
 B. $7\sqrt{47}$
 C. 49
 D. 63
 E. $16\sqrt{47}$

50. If $8a^6b^3 < 0$, then which of the following CANNOT be true?

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

51. If $\log_4 x = 3$, then $x = ?$

 A. $\dfrac{1}{\log_{12}}$
 B. $4\log^3$
 C. 12
 D. 64
 E. 81

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52. 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?

DO YOUR FIGURING HERE.

F. $y = -2$

G. $y = -\dfrac{1}{4}x + 2$

H. $y = -2x - 4$

J. $y = \dfrac{4}{3}x + 2$

K. $y = 4x - 4$

53. In a game, 80 marbles numbered 00 through 79 are placed in a box. A player draws 1 marble at random from the box. Without replacing the first marble, the player draws a second marble at random. If both marbles drawn have the same ones digit (that is, both marbles have a number ending in 0, 1, 2, 3, etc.), the player is a winner. If the first marble drawn is numbered 35, what is the probability that the player will be a winner on the next draw?

A. $\dfrac{1}{79}$

B. $\dfrac{7}{80}$

C. $\dfrac{7}{79}$

D. $\dfrac{1}{10}$

E. $\dfrac{8}{79}$

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54. In the standard (x,y) coordinate plane, what is the equation of the line that passes through the origin and the point (3,4)?

F. $y = \frac{1}{4}x + \frac{3}{4}$

G. $y = \frac{1}{4}x - \frac{1}{3}$

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

J. $y = \frac{1}{2}x + \frac{3}{4}$

K. $y = \frac{9}{4}x$

55. The measure of the vertex angle of an isosceles triangle is $(a + 30)°$. The base angles each measure $(2a - 15)°$. What is the measure in degrees of one of the base angles?

A. 36°
B. 45°
C. 57°
D. 66°
E. 90°

56. What is the smallest possible value for the product of 2 integers that differ by 7?

F. 8
G. 0
H. −6
J. −10
K. −12

57. Three distinct lines, all contained within a plane, separate that plane into distinct regions. What are all of the possible numbers of distinct regions of the plane that could be separated by any such three lines?

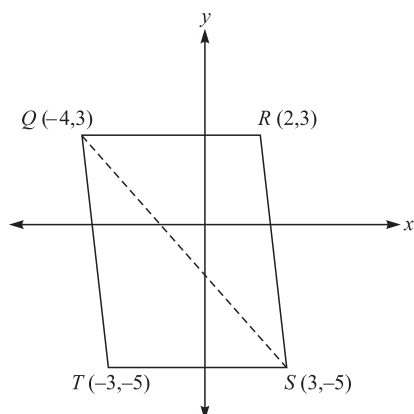**A.** 4, 6, 7
B. 4, 5, 6
C. 3, 5, 7
D. 3, 5, 6
E. 3, 4, 5

DO YOUR FIGURING HERE.

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58. Given the vertices of parallelogram $QRST$ in the standard (x, y) coordinate plane below, what is the area of triangle QRS, in square units?

DO YOUR FIGURING HERE.

F. 24
G. 28
H. 48
J. 60
K. 80

59. The first and second terms of a geometric sequence are a and ab, in that order. What is the 643rd term of the sequence?
A. $(ab)^{642}$
B. $(ab)^{643}$
C. $a^{642}b$
D. $a^{643}b$
E. ab^{642}

60. Points A, B, and C are three distinct points that lie on the same line. If the length of AB is 19 meters and the length of BC is 13 meters, then what are all the possible lengths, in meters, for AC?
F. 6 only
G. 32 only
H. 6 and 32 only
J. Any number less than 32 or greater that 6
K. Any number greater than 32 or less than 6

END OF THE MATHEMATICS TEST.
STOP! IF YOU HAVE TIME LEFT OVER, CHECK YOUR WORK ON THIS SECTION ONLY.

Mathematics Test

1. B	21. B	41. B
2. K	22. F	42. H
3. C	23. B	43. A
4. H	24. J	44. F
5. C	25. A	45. B
6. J	26. G	46. K
7. B	27. B	47. A
8. H	28. G	48. H
9. D	29. E	49. D
10. K	30. G	50. G
11. C	31. C	51. D
12. K	32. F	52. J
13. A	33. C	53. C
14. F	34. G	54. H
15. B	35. B	55. C
16. H	36. K	56. K
17. B	37. A	57. A
18. H	38. F	58. F
19. E	39. A	59. E
20. G	40. G	60. H