



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. What is the average of 3, 3, and 4?

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

2. A positive number plus its square is equal to 56. What is the number?

- F. 5
- G. 6
- H. 7
- J. 8
- K. 9

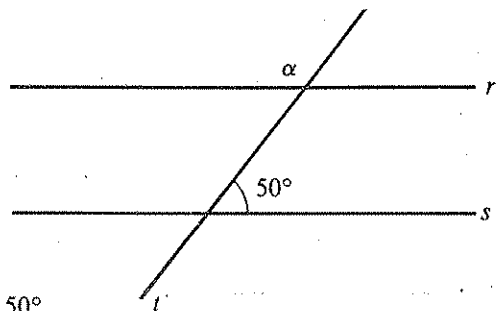
3. For all x , $(2x - 3)(x + 5) = ?$

- A. $x^2 + 2x - 15$
- B. $2x^2 - 13x - 15$
- C. $2x^2 + 2x - 15$
- D. $2x^2 + 2x + 15$
- E. $2x^2 + 7x - 15$

4. A beaker of liquid cools from 19° to -6° . By how many degrees has it cooled?

- F. 6°
- G. 13°
- H. 19°
- J. 25°
- K. 26°

5. In the figure below, parallel lines r and s are intersected by line t . What is the measure of angle α ?

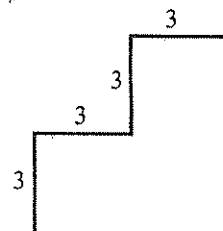


- A. 50°
- B. 100°
- C. 130°
- D. 140°
- E. 150°

6. Ticket sales for this year's annual concert at County Stadium were \$350,000. The promoter is predicting that next year's ticket sales, in dollars, will be 60% greater than this year's. How many dollars in ticket sales is the promoter predicting for next year?

- F. \$350,060
- G. \$410,000
- H. \$560,000
- J. \$583,333
- K. \$950,000

7. Adjacent segments in the hexagon below are perpendicular, and 4 segments are each 3 yards long, as marked. What is the perimeter of the hexagon, in yards?



- A. 12
- B. 18
- C. 24
- D. 27
- E. 30



8. For all a and b , $3a^2b^3(2a^3b^3) = ?$

- F. $5a^5b^6$
- G. $5a^6b^9$
- H. $6a^2b^3$
- J. $6a^5b^6$
- K. $6a^6b^9$

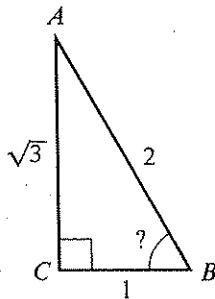
9. In a certain triangle, the longest side is 1 foot longer than the second-longest side, and the second-longest side is 1 foot longer than the shortest side. If the perimeter is 21 feet, how many feet long is the shortest side?

- A. 6
- B. 7
- C. 8
- D. 9
- E. 10

10. What is 5% of 50?

- F. 0.5
- G. 2.5
- H. 5
- J. 10
- K. 25

11. What is the measure of $\angle ABC$ in the triangle below?



- A. 15°
- B. 30°
- C. 45°
- D. 60°
- E. 75°

12. Anna wants to completely cover the rectangular ceiling of her room with soundproof tile so she can play her stereo as loudly as she wants. Her ceiling is 16 feet long and 10 feet wide. The tiles are 2-foot-by-2-foot squares. How many tiles does Anna need to cover her ceiling with one layer of soundproof tiles?

- F. 20
- G. 26
- H. 40
- J. 52
- K. 80

13. What is the midpoint of the line segment with endpoints of $(-3,5)$ and $(5,9)$?

- A. $(-3,7)$
- B. $(1,5)$
- C. $(1,7)$
- D. $(4,7)$
- E. $(5,7)$

14. What is the smallest positive integer x such that $|2 - x| \geq 6$?

- F. 3
- G. 5
- H. 6
- J. 7
- K. 8

15. What is the greatest prime factor of 520?

- A. 5
- B. 7
- C. 11
- D. 13
- E. 17

16. What is the value of $x^3 - x^2 - x$ when $x = -1$?

- F. -3
- G. -1
- H. 0
- J. 1
- K. 3

17. Running at a steady pace of 90 seconds per quarter mile, how many minutes would it take to run 2 miles?

- A. 12.0
- B. 8.0
- C. 7.2
- D. 4.5
- E. 3.0

18. If $a = 0.3$ and $b = 0.4$, then $ab^2 = ?$

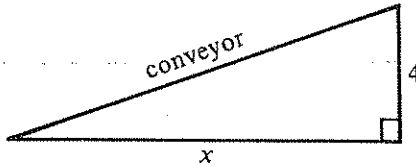
- F. 0.0144
- G. 0.019
- H. 0.048
- J. 0.24
- K. 0.49

19. $\sqrt{x-5}$ is a real number if and only if:

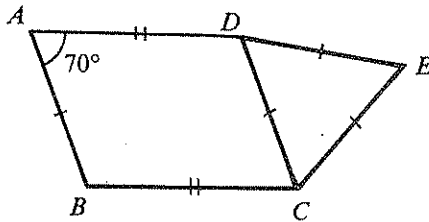
- A. $x \leq -5$
- B. $-5 < x < 0$
- C. $x = 0$
- D. $0 < x < 5$
- E. $x \geq 5$



20. The manufacturer of an airport baggage conveyor recommends a slope of no more than 0.25. If the baggage conveyor in the figure below rises 4 feet, what is the minimum acceptable value for x , in feet?



- F. $4\frac{1}{4}$
 G. 5
 H. 16
 J. 25
 K. 29
21. The figure below is made from a parallelogram, $ABCD$, and an equilateral triangle, $\triangle CDE$. What is the measure of $\angle ADE$?



- A. 110°
 B. 130°
 C. 150°
 D. 170°
 E. 190°
22. Which equation below has the solutions $x = p$ and $x = q$?
- F. $(x - p)(x - q) = 0$
 G. $(x - p)(x - q) = 1$
 H. $(x + p)(x + q) = 0$
 J. $x + p + q = 0$
 K. $x + pq = 0$

23. Which of the following is an irrational number?
- A. $|-1.9|$
 B. 0
 C. $\frac{1}{7}$
 D. 0.3
 E. $\sqrt{6}$

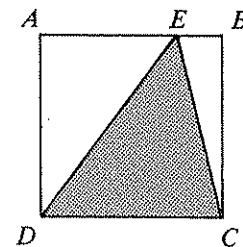
24. In the (x, y) coordinate plane, what is the slope of the line $y = x - 5$?

- F. -5
 G. -1
 H. $\frac{1}{5}$
 J. 1
 K. 5
25. What is the smallest number greater than 1 that, when divided by 2, 3, 4, 5, or 6, leaves a remainder of 1 in each case?
- A. 7
 B. 31
 C. 61
 D. 121
 E. 721

26. A car rental company charges \$50.00 per day plus \$0.80 per mile for a full-size car, and charges \$30.00 per day plus \$0.50 per mile for a compact car. Which expression below gives the amount, in dollars, that the charge for a full-size car exceeds the charge for a compact car, when each is rented for x days and y miles?

- F. $-20x - 0.30y$
 G. $20x + 0.30y$
 H. $20x + 30y$
 J. $20x + 1.30y$
 K. $80x + 1.30y$
27. A square has an area of 41.3 square centimeters. If s is the side length of the square in centimeters, then s must lie between which 2 consecutive integers?
- A. $4 < s < 5$
 B. $6 < s < 7$
 C. $10 < s < 11$
 D. $20 < s < 21$
 E. $41 < s < 42$

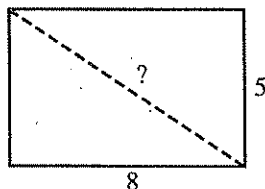
28. In the figure below, square $ABCD$ has sides 12 centimeters long, and E is on side \overline{AB} . In square centimeters, what is the area of $\triangle DEC$?



- F. 36
 G. 48
 H. 72
 J. 96
 K. 144



29. How many centimeters long is the diagonal of a rectangle that is 5 centimeters wide and 8 centimeters long, as shown below?



- A. 13
 B. $\sqrt{13}$
 C. $\sqrt{40}$
 D. $\sqrt{89}$
 E. $\sqrt{99}$

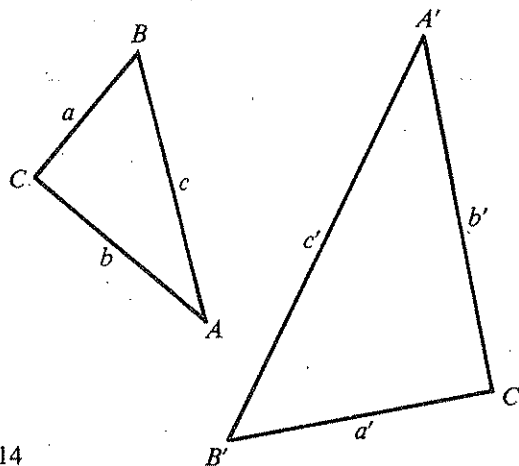
30. Near a large city, planes take off from two airfields. One of the fields is capable of sending up a plane every 3 minutes. The other field is capable of sending up 2 planes every 7 minutes. At these rates, which of the following is the most reasonable estimate of the total number of planes the two airfields could send up in 90 minutes?

- F. 18
 G. 27
 H. 36
 J. 44
 K. 55

31. What are the (x,y) coordinates of the unique point on the graph of $x + 4y = 18$ such that the y -coordinate of that point is twice the x -coordinate?

- A. (1,2)
 B. (2,4)
 C. (3,6)
 D. (4,8)
 E. (9,18)

32. The figure below shows 2 triangles, where $\triangle ABC \sim \triangle A'B'C'$. In these similar triangles, $a = 9$, $b = 12$, $c = 15$, and $a' = 15$, with all dimensions given in feet. What is the value of b' ?



- F. 14
 G. 16
 H. 18
 J. 20
 K. 22

33. In the (x,y) coordinate plane, if the point $(-4,2)$ is on the graph of $y = ax^2$, what is the value of a ?

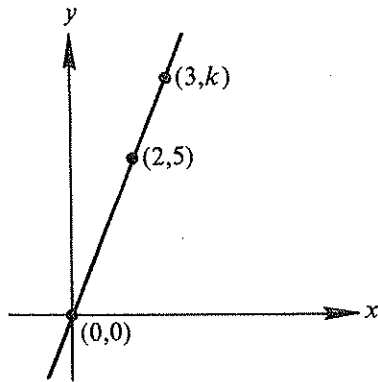
- A. -1
 B. 1
 C. $-\frac{1}{2}$
 D. $-\frac{1}{8}$
 E. $\frac{1}{8}$

34. The two parabolas $y = ax^2 + n$ and $y = x^2 + q$ have the same vertex when graphed in the (x,y) coordinate plane. Which of the following *must* be true?

- F. $n + q = 0$
 G. $nq = a$
 H. $nq = 1$
 J. $a = 1$
 K. $n = q$



35. In the (x,y) coordinate plane below, a straight line passes through the 3 indicated points. What is the value of k ?

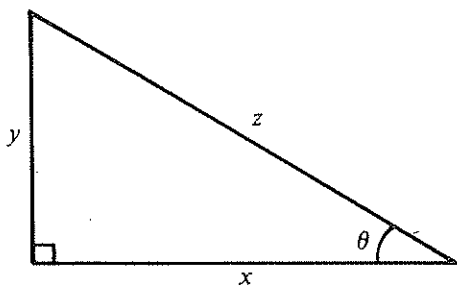


- A. $-\frac{15}{2}$
- B. $-\frac{6}{5}$
- C. $\frac{6}{5}$
- D. 6
- E. $\frac{15}{2}$

36. A circle has a diameter of 6 inches. What is the circle's area, in square inches?

- F. 6π
- G. 9π
- H. 12π
- J. 18π
- K. 36π

37. For the right triangle below, which of the following expressions is equal to $\cos \theta$?

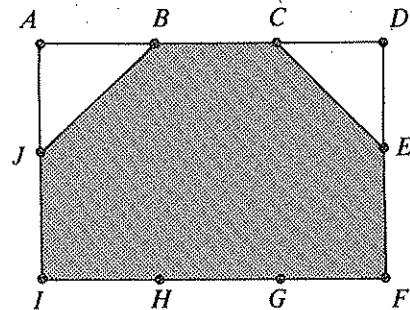


- A. $\frac{x}{y}$
- B. $\frac{x}{z}$
- C. $\frac{y}{x}$
- D. $\frac{y}{z}$
- E. $\frac{z}{x}$

38. For all $x > 0$, which of the following is a simplified form of $\frac{3x^2 + 14x + 8}{x^2 + 6x + 8}$?

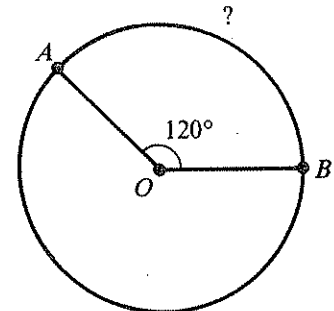
- F. $\frac{3x+2}{x+2}$
- G. $\frac{(3x+1)(x+8)}{(x+2)(x+4)}$
- H. $3x+2$
- J. $2x^2 + 8x$
- K. $6\frac{1}{3}$

39. In rectangle $ADFI$ below, the 10 labeled points are equally spaced along the perimeter. What is the ratio of the shaded area to the area of the entire rectangle?



- A. $\frac{7}{8}$
- B. $\frac{5}{6}$
- C. $\frac{4}{5}$
- D. $\frac{3}{4}$
- E. $\frac{2}{3}$

40. If the circumference of the circle below is 93 parsecs, and O is the center of the circle, how many parsecs long is minor arc \widehat{AB} ?



- F. 31
- G. 31π
- H. $\frac{93}{\pi}$
- J. 213
- K. 11,160



41. One of the angles in an isosceles triangle measures 24° . Which of the following is a possible measure for another of the triangle's angles?

A. 42°
 B. 52°
 C. 66°
 D. 78°
 E. 156°

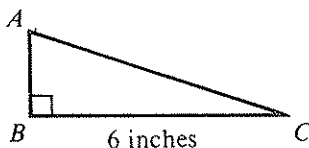
42. For all real x and m , if $(x - 1)(x + m) = x^2 + kx - m$, then $k = ?$

F. 0
 G. 1
 H. m
 J. $m + 1$
 K. $m - 1$

43. If the product of 5 integers is positive, at least how many of these 5 integers *must* be positive?

A. 1
 B. 2
 C. 3
 D. 4
 E. 5

44. In the right triangle below, if $\angle C$ has a sine of $\frac{2}{\sqrt{29}}$, a cosine of $\frac{5}{\sqrt{29}}$, and a tangent of $\frac{2}{5}$, how many inches long is \overline{AB} ?



F. $\frac{2}{5}$

G. $\frac{12}{5}$

H. $\frac{12}{\sqrt{29}}$

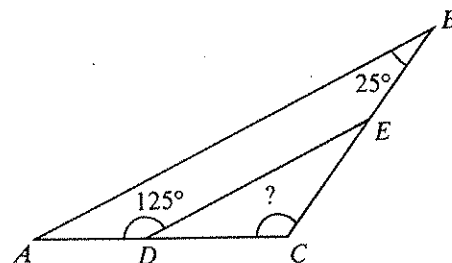
J. $\frac{30}{\sqrt{29}}$

K. 6

45. A 45-foot wire is cut into 2 pieces whose lengths are in the ratio 2:3. What is the length of the shorter piece, in feet?

A. 9
 B. 15
 C. 18
 D. $22\frac{1}{2}$
 E. 30

46. For $\triangle ABC$ below, D and E are points on the sides of the triangle. If \overline{AB} is parallel to \overline{DE} , what is the measure of $\angle ACB$?



F. 80°
 G. 100°
 H. 125°
 J. 150°
 K. 155°

47. The distance around a circular path is 1,000 meters. Which of the following most nearly approximates the radius of the path, in meters?

(Note: $\pi \approx 3.14$)

A. 10
 B. 18
 C. 32
 D. 159
 E. 318

48. What is the value of $(x + 2)(x - 3) + 5$ when $x^2 - x - 6 = -4$?

F. -2
 G. -1
 H. 1
 J. 2
 K. 3

49. Elkville High won a Friday night basketball game by 10 points; the next night they scored 25 points more than on Friday and again won by 10 points. The sum of the opponents' scores for the 2 games was 109. How many points did Elkville score on Friday?

A. 37
 B. 41
 C. 46
 D. 52
 E. 72

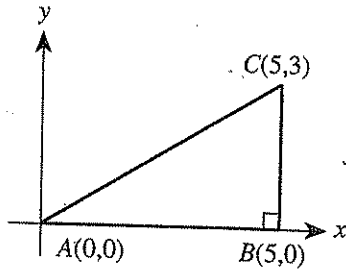
50. If $x = 3^a$ and $y = 3^{-a}$ then what is y in terms of x ?

F. $y = \frac{1}{x}$
 G. $y = -\frac{1}{x}$
 H. $y = \frac{3}{x}$
 J. $y = -x$
 K. $y = x^{-3}$



51. In the figure below, what is the sine of $\angle BAC$?

- A. $\frac{3}{5}$
- B. $\frac{3}{4}$
- C. $\frac{5}{3}$
- D. $\frac{3}{\sqrt{34}}$
- E. $\frac{5}{\sqrt{34}}$



52. While watching TV from 7:00 P.M. to 8:00 P.M., you count 20 commercials, each 30 seconds long. To the nearest percent, what percent of the hour is taken up by commercials?

- F. 6%
- G. 10%
- H. 17%
- J. 50%
- K. 60%

53. The sum of the 3 integers x , y , and z is 100. If $0 < x < 40$, and $y < 0$, what is the smallest possible value for z ?

- A. 58
- B. 59
- C. 60
- D. 61
- E. 62

54. If $(x + m)^2 = x^2 + 12x + n$, where m and n are integers, what is the value of n ?

- F. 36
- G. 30
- H. 24
- J. 18
- K. 12

55. What is the length, in coordinate units, of the diameter of a circle whose endpoints have coordinates $(12,3)$ and $(6,-5)$ in the standard (x,y) coordinate plane?

- A. $\sqrt{28}$
- B. $\sqrt{80}$
- C. $\sqrt{82}$
- D. $\sqrt{100}$
- E. $\sqrt{202}$

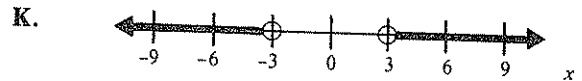
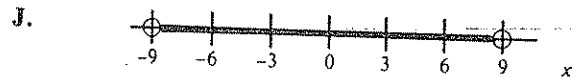
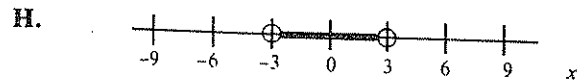
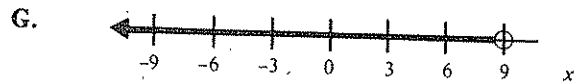
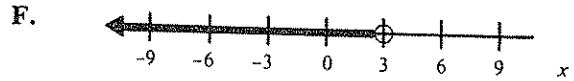
56. The circle $(x - 1)^2 + (y - 2)^2 = 26$ intersects the y -axis in two points, one of which is $(0,7)$. At what other point does the circle intersect the y -axis?

- F. $(0,-7)$
- G. $(0,-3)$
- H. $(0,3)$
- J. $(0,\sqrt{26})$
- K. $(7,0)$

57. If $x + y = 6$, then $x^2 = ?$

- A. $y^2 - 12y - 36$
- B. $y^2 - 36$
- C. $6 - y^2$
- D. $36 - y^2$
- E. $36 - 12y + y^2$

58. Which of the following is the graph of the solution set for $x^2 < 9$?



59. There is a pattern in the units digit of the positive integer powers of each whole number. Some powers of 2 are shown below. What is the units digit of 3^{45} ?

| Powers of 2 | Units digit |
|-------------|-------------|
| $2^1 = 2$ | 2 |
| $2^2 = 4$ | 4 |
| $2^3 = 8$ | 8 |
| $2^4 = 16$ | 6 |
| $2^5 = 32$ | 2 |
| $2^6 = 64$ | 4 |
| $2^7 = 128$ | 8 |
| $2^8 = 256$ | 6 |

- A. 1
- B. 3
- C. 5
- D. 7
- E. 9

2**2**

60. Whenever $\frac{2 \cos \alpha \sin \alpha}{\cos^2 \alpha + 1 - \sin^2 \alpha}$ is defined, it simplifies to:

F. $\tan \alpha$

G. $\cot \alpha$

H. 2

J. $\frac{2}{\cos \alpha - \sin \alpha}$

K. $\sin \alpha \cos \alpha$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.