



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. The Crossroads High School basketball team sponsored a student/faculty basketball game. Tickets sold for \$5.00 each. Each person with a ticket was entitled to admission to the game, 1 pretzel, and 1 can of soda. Each additional pretzel cost \$1.00 and each additional can of soda cost \$1.50. The basketball team sold 120 tickets. At the game, 36 additional pretzels were sold. The team collected a total of \$702.00. How many additional cans of soda were sold?

- A. 44
- B. 48
- C. 68
- D. 92
- E. 364

2. In football, total offense consists of rushing offense and passing offense. The table below shows rushing offense and total offense for a college football program during a 3-year period.

Rushing offense			
Year	Carries	Total yards	Yards per game
1997	397	1,028	93.5
1998	394	1,417	128.8
1999	378	1,920	213.3
Total offense			
Year	Plays	Total yards	Yards per game
1997	783	3,579	325.4
1998	759	3,692	335.6
1999	604	3,452	383.6

In 1997, what was the number of yards of total offense that was passing offense?

- F. 1,532
- G. 2,162
- H. 2,275
- J. 2,551
- K. 2,664

DO YOUR FIGURING HERE.

63-D

DO YOUR FIGURING HERE.

3. A 7-day week is how many times as long as 60 minutes?

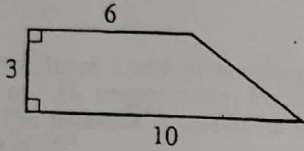
- A. 24
- B. 31
- C. 52
- D. 84
- E. 168

4. Veata earns f dollars per hour for h hours and then earns g dollars per hour for $3h$ hours. In terms of f , g , and h , these earnings totaled how many dollars?

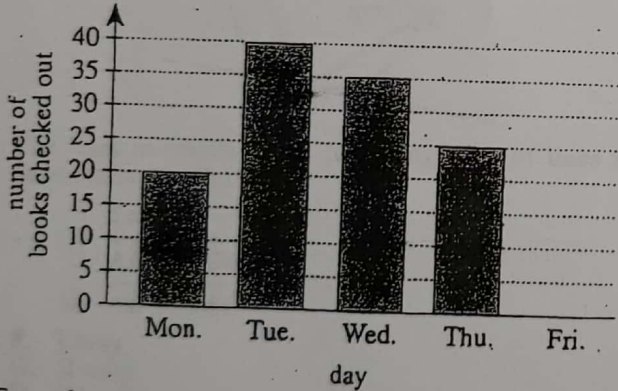
- F. $3fgh$
- G. $3fgh^2$
- H. $fh + 3g$
- J. $fh + 3gh$
- K. $3fh + 3gh$

5. A trapezoid is shown below with the given dimensions in meters. What is the area, in square meters, of the trapezoid?

- A. 9
- B. 15
- C. 18
- D. 24
- E. 48



6. The graph below shows the number of books checked out of the school library on the first 4 days of a 5-day week. How many books need to be checked out on Friday for the 5-day week's mean to equal the mean of the first 4 days?



- F. 0
- G. 24
- H. 30
- J. 40
- K. 120

7. A ball is kicked upward. It is h feet above the ground t seconds after it is kicked. The relationship between h and t is given by the equation $h = 50t - 16t^2$. How many feet above the ground is the ball 2 seconds after it is kicked?

- A. 34
- B. 36
- C. 50
- D. 68
- E. 84

DO YOUR FIGURING HERE.

8. The high and low temperatures for a 5-day period are listed below. Which day had the greatest range of temperatures?

Day	High	Low
Monday	30°F	12°F
Tuesday	32°F	14°F
Wednesday	29°F	10°F
Thursday	25°F	8°F
Friday	28°F	16°F

- F. Monday
- G. Tuesday
- H. Wednesday
- J. Thursday
- K. Friday

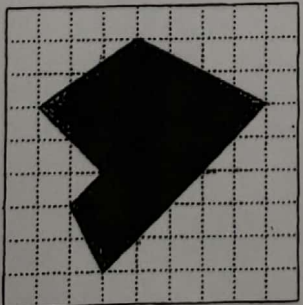
9. Siblings Peter, Paul, and Mary earned a total of \$200 shoveling snow. If Peter earned 37% of the total and Paul earned \$16, what fraction of the \$200 did Mary earn?

- A. $\frac{1}{3}$
- B. $\frac{1}{2}$
- C. $\frac{11}{20}$
- D. $\frac{131}{200}$
- E. $\frac{147}{200}$

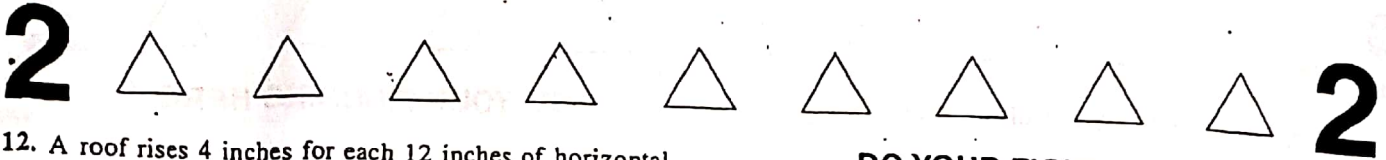
10. For $f(x) = 2x + 10$ and $g(x) = 3x^2$, what is the value of $f(g(-3))$?

- F. 31
- G. 48
- H. 64
- J. 108
- K. 144

11. Each small square on the grid shown below has a side length of 1 cm. Each vertex of the shaded region lies on a vertex of a small square. What is the area, in square centimeters, of the shaded region?



- A. 17
- B. 23
- C. 28
- D. 29
- E. 39

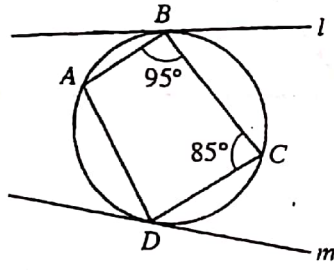


DO YOUR FIGURING HERE.

12. A roof rises 4 inches for each 12 inches of horizontal run. This roof rises $30\frac{1}{2}$ inches in how many inches of horizontal run?
- F. $10\frac{1}{6}$
 - G. $22\frac{1}{2}$
 - H. $38\frac{1}{2}$
 - J. $91\frac{1}{2}$
 - K. 122

13. When $a = 4$ and $b = -2$, $(2a - b) + b^a = ?$
- A. -10
 - B. -6
 - C. 2
 - D. 22
 - E. 26

14. In the figure below, lines l and m are tangent to the circle at points B and D , respectively. Points A and C are on the circle. The measure of $\angle ABC$ is 95° and the measure of $\angle BCD$ is 85° .



The lines in which of the following pairs of lines are necessarily parallel?

- I. l and m
 - II. \overleftrightarrow{AB} and \overleftrightarrow{DC}
 - III. \overleftrightarrow{AD} and \overleftrightarrow{BC}
- F. I only
 - G. II only
 - H. III only
 - J. I and II only
 - K. I, II, and III
15. Each day, a grocery store sells 112 gallons of milk for \$2.10 per gallon. The owner of the grocery store has determined that for each \$0.03 increase in the price per gallon of milk, the number of gallons sold will decrease by 2. If x represents the number of \$0.03 increases in the price of a gallon of milk, which of the following expressions represents the daily amount of money, in dollars, the grocery store will collect from the sale of milk?
- A. $(2.10 - 0.03x)(112 - 2x)$
 - B. $(2.10 + 0.03x)(112 - 2x)$
 - C. $(2.10 + 0.03x)(112 - 0.02x)$
 - D. $(2.10 - 3x)(112 - 2x)$
 - E. $(2.10 + 3x)(112 - 2x)$



16. The expression $x^2 + 5x - 6$ is equivalent to:

- F. $(x - 6)(x + 1)$
- G. $(x - 6)(x + 5)$
- H. $(x - 3)(x - 2)$
- J. $(x - 3)(x + 2)$
- K. $(x - 1)(x + 6)$

DO YOUR FIGURING HERE.

17. When $a = 2$ and $b = 3$, the expression

$$\frac{ab^6}{25} + \frac{11}{10(a+b)} + \frac{1}{a+b} = ?$$

- A. $\frac{9}{40}$
- B. $\frac{11}{20}$
- C. $\frac{31}{50}$
- D. $\frac{47}{75}$
- E. $\frac{33}{50}$

18. The hours and minutes on a 12-hour digital clock are represented by 3 or 4 digits. Which of the following is the *largest* product that can be obtained by multiplying the digits in one of these representations?

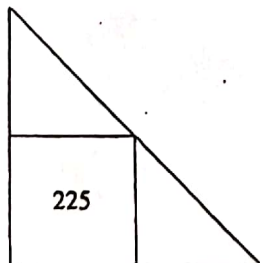
(Note: If the time is 8:45, the product of the digits is $(8)(4)(5) = 160$.)

- F. 90
- G. 162
- H. 405
- J. 708
- K. 729

19. The difference of 2 integers is 4. The sum of the same 2 integers is 38. What is the greater of the 2 integers?

- A. 17
- B. 18
- C. 19
- D. 20
- E. 21

20. In the figure below, the small isosceles right triangles are congruent. The area of the square is 225 square inches. What is the total area, in square inches, of the 2 small triangles?

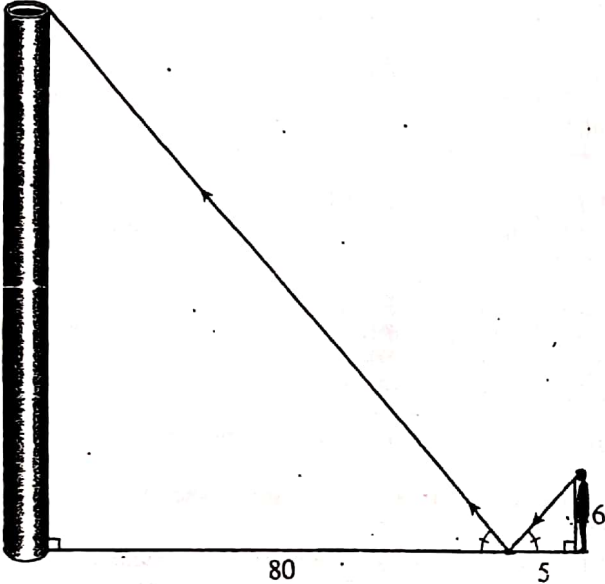


- F. 75
- G. 112.5
- H. 150
- J. 225
- K. 450

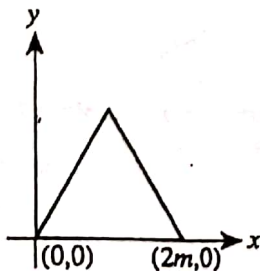


DO YOUR FIGURING HERE.

21. To measure the height of a smokestack, Ariel places a mirror on level ground 80 feet from the base of the smokestack. He then forms 2 similar triangles by looking into the mirror and backing up until he sees the reflection of the top of the smokestack, as shown below. Ariel's eyes are 6 feet from the ground and he is 5 feet from the image in the mirror. Which of the following is closest to the height, in feet, of the smokestack?



- A. 110
 B. 96
 C. 91
 D. 85
 E. 67
22. For what value of x , if any, is the equation $(x + 5)^2 = (x + 1)^2$ true?
 F. -3
 G. -1
 H. 0
 J. 3
 K. There is no value of x for which the equation is true.
23. An equilateral triangle, with the coordinates of 2 vertices labeled, is shown in the standard (x,y) coordinate plane below. Which of the following are the coordinates of the 3rd vertex?



- A. $(0, m)$
 B. (m, m)
 C. $(m, m\sqrt{3})$
 D. $(m\sqrt{3}, m)$
 E. $(m\sqrt{3}, m\sqrt{3})$



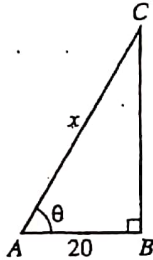
24. The diagonal of a square is $2\sqrt{2}$ inches long. What is the area of the square, in square inches?

F. $\sqrt{2}$
 G. 2
 H. $2\sqrt{2}$
 J. 4
 K. $4\sqrt{2}$

DO YOUR FIGURING HERE.

25. In the figure below, \overline{AC} represents a support wire x feet long. The wire is attached to a tower at C and to the ground at A . The distance between A and B , which is at the base of the tower, is 20 feet. The angle at A has measure θ . Which of the following relationships must be true?

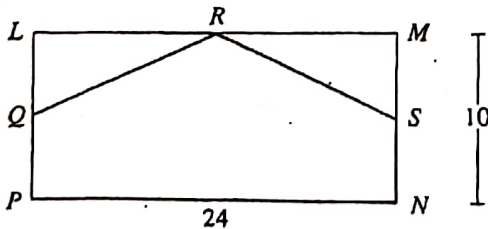
A. $\cos \theta = \frac{20}{x}$
 B. $\sin \theta = \frac{20}{x}$
 C. $\sin \theta = \frac{x}{20}$
 D. $\tan \theta = \frac{20}{x}$
 E. $\tan \theta = \frac{x}{20}$



26. The equation $\sqrt{x} + \sqrt{x-16} = 8$ is true for what real value of x ?

F. 9
 G. 16
 H. 25
 J. 36
 K. 64

27. In rectangle $LMNP$ below, \overline{NP} is 24 inches long and \overline{MN} is 10 inches long. Points Q , R , and S are the midpoints of \overline{LP} , \overline{LM} , and \overline{MN} , respectively. What is the perimeter, in inches, of pentagon $NPQRS$?



A. 60
 B. 68
 C. 70
 D. 120
 E. 180



Use the following information to answer questions 28–30.

DO YOUR FIGURING HERE.

The table below gives data about the population of the U.S. for 1990, 1995, and 1999.

U.S. population category	1990	1995	1999
Group*			
Total	248.8	262.8	272.9
Male	121.3	128.3	133.4
Female	127.5	134.5	139.5
Age group†			
Under 18 years	25.7%	26.1%	25.7%
65 years and over	12.5%	12.8%	12.7%
Region‡			
Northeast	20.4%	19.6%	19.0%
Midwest	24.0%	23.6%	23.2%
South	34.4%	34.9%	35.4%
West	21.2%	21.9%	22.4%

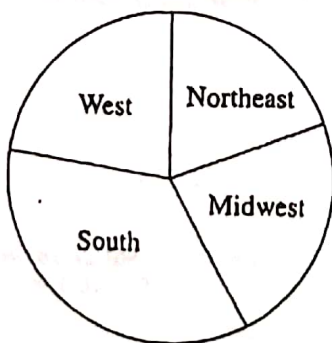
*in millions of people, rounded to the nearest tenth of a million
 †in percent, rounded to the nearest tenth of a percent
 ‡in percent, rounded to the nearest tenth of a percent

28. To the nearest percent, what percent of the total U.S. population in 1999 was male?

- F. 50%
- G. 49%
- H. 48%
- J. 47%
- K. 20%

29. The circle graph (pie chart) below represents the 1999 U.S. population distribution for the 4 regions listed. To the nearest degree, what is the measure of the central angle of the "West" sector?

1999 Population Distribution



- A. 81°
- B. 76°
- C. 68°
- D. 40°
- E. 22°

30. Expressed in millions of people, what was the average growth per year in total U.S. population from 1990 to 1995, rounded to the nearest 0.1 million?

- F. 2.8
- G. 2.7
- H. 2.0
- J. 1.4
- K. 1.0



DO YOUR FIGURING HERE.

31. Every camera lens has a measurement called the focal length, f , such that when an object is in focus, the distance from the object to the center of the lens, D_o , and the distance from the center of the lens to the film, D_i , satisfy the equation $\frac{1}{D_o} + \frac{1}{D_i} = \frac{1}{f}$. If the object is in focus, $D_o = 36$ centimeters, and $D_i = 12$ centimeters, what is the focal length of the lens, in centimeters?

A. 3
 B. 6
 C. 9
 D. 12
 E. 24

32. What is the probability of randomly choosing a prime number from $\{2, 3, 4, 5, 6\}$?

F. 0
 G. $\frac{1}{5}$
 H. $\frac{2}{5}$
 J. $\frac{3}{5}$
 K. $\frac{4}{5}$

33. For $g(x,y) = 5x + 4y$, what is the value of $g(x,y)$ when $y = \left(\frac{3}{x}\right)^2$ and $x = 2$?

A. $\frac{23}{2}$
 B. $\frac{49}{4}$
 C. 16
 D. 19
 E. 28

34. What is the length, in coordinate units, of a diagonal of the rectangle that has $(0,3)$, $(4,3)$, and $(4,0)$ as 3 of its vertices in the standard (x,y) coordinate plane?

F. 3
 G. 4
 H. 5
 J. 6
 K. 7

35. What is the value of x if $\log_5 x = 2$?

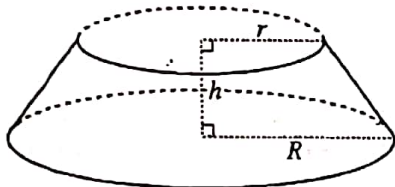
A. $\sqrt{5}$
 B. $\sqrt[3]{2}$
 C. 10
 D. 25
 E. 100



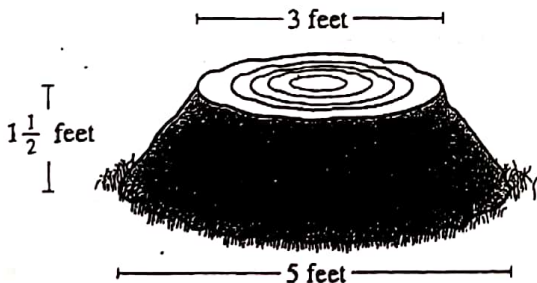
36. The fuel remaining in the gas tank of a particular car that starts with a full 16-gallon tank of gas can be approximated by the equation $y = 16 - 0.05x$, where x is the number of miles the car has traveled for $0 \leq x \leq 320$, and y is the number of gallons remaining in the tank. According to this equation, which of the following statements is true about this car?

- F. In traveling 0.05 miles, the car uses 1 gallon of gas.
- G. In traveling 1 mile, the car uses 0.05 gallons of gas.
- H. In traveling 16 miles, the car uses 0.05 gallons of gas.
- J. In traveling 16 miles, the car uses 1 gallon of gas.
- K. In traveling 80 miles, the car uses 16 gallons of gas.

37. A formula for the volume of a right circular cone with its top removed is $V = \frac{1}{3}\pi h(R^2 + r^2 + Rr)$, where R and r are radii and h is height, as shown in the figure below.



The number of cubic feet of wood in a tree stump can be estimated using the formula given. About how many cubic feet of wood are there in the tree stump shown below?



- A. 12
 - B. 18
 - C. 19
 - D. 38
 - E. 77
38. Which of the following is the set of real solutions for the equation $6x + 10 = 2(3x + 5)$?

- F. The empty set
- G. $\{-\frac{5}{3}\}$
- H. $\{0\}$
- J. $\{0, 1\}$
- K. The set of all real numbers

DO YOUR FIGURING HERE.

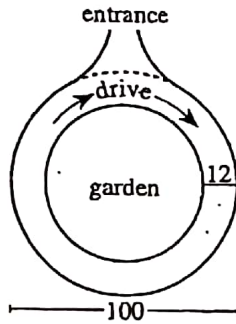


DO YOUR FIGURING HERE.

39. The expression $\frac{\frac{1}{2}}{\frac{1}{2} + \frac{1}{3}}$ equals:

- A. $\frac{36}{65}$
- B. $\frac{13}{20}$
- C. $\frac{18}{13}$
- D. $\frac{20}{13}$
- E. $\frac{8}{3}$

40. The figure below shows a circular garden surrounded by a circular drive. The outside circle of the drive has a diameter of 100 meters and the drive has a uniform width of 12 meters. Which of the following is closest to the area, in square meters, of the garden?

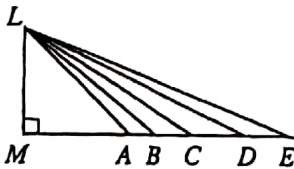


- F. 240
- G. 310
- H. 4,500
- J. 7,900
- K. 18,000

41. For all nonzero real numbers x and y , what is the value of $x^0 + y^0$?

- A. 2
- B. 1
- C. 0
- D. $x + y$
- E. Undefined

42. In the figure below, $LM = MA$, and $A, B, C,$ and D are on \overline{ME} . Of the angles $\angle LAM, \angle LBM, \angle LCM, \angle LDM,$ and $\angle LEM$, which one has the smallest sine?



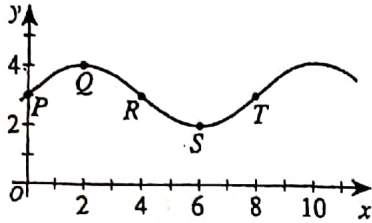
- F. $\angle LAM$
- G. $\angle LBM$
- H. $\angle LCM$
- J. $\angle LDM$
- K. $\angle LEM$



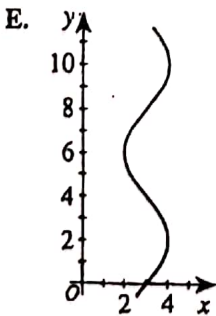
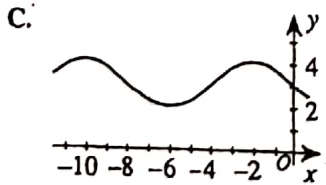
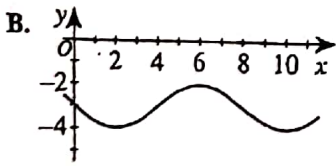
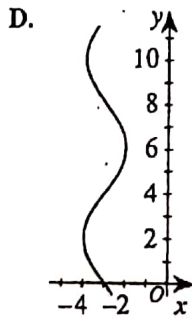
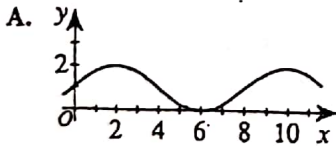
Use the following information to answer questions 43–45.

DO YOUR FIGURING HERE.

The graph of $y = f(x)$ is shown in the standard (x,y) coordinate plane below with 5 points labeled.



43. Which of the following points is the y -intercept of the graph of $y = f(x)$?
- A. P
 - B. Q
 - C. R
 - D. S
 - E. T
44. The function $y = f(x)$ can be classified as one of the following types of functions. Which one is it?
- F. Constant
 - G. Linear
 - H. Quadratic
 - J. Cubic
 - K. Trigonometric
45. Which of the following graphs is the reflection of $y = f(x)$ across the line $y = x$?





DO YOUR FIGURING HERE.

46. If x is a factor of 35 and y is a factor of 16, the product of x and y could NOT be which of the following?

F. 1
 G. 24
 H. 40
 J. 112
 K. 560

47. For each positive integer n , let n_e be the product of all positive even numbers less than or equal to n . For example, $6_e = (6)(4)(2) = 48$ and $7_e = (6)(4)(2) = 48$.

What is the value of $\frac{12_e}{3_e}$?

A. 384
 B. 1,280
 C. 1,920
 D. 15,360
 E. 23,040

48. If $(1, b)$ is on the graph of the equation $x - 3y = 7$ in the standard (x, y) coordinate plane, then $b = ?$

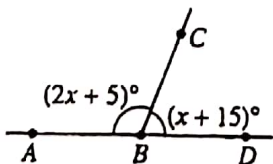
F. $-\frac{8}{3}$
 G. -2
 H. 2
 J. 3
 K. 6

49. For all $x > 0$, what happens to the value of $\frac{x^2 + x}{x} - x$, as x increases?

A. It decreases in proportion to x^2 .
 B. It decreases in proportion to x .
 C. It increases in proportion to x .
 D. It increases in proportion to x^2 .
 E. It remains constant.

50. In the figure below, B is on \overline{AD} and the angle measures are as given. What is the degree measure of $\angle ABC$?

F. $111\frac{2}{3}^\circ$
 G. $106\frac{2}{3}^\circ$
 H. $68\frac{1}{3}^\circ$
 J. $53\frac{1}{3}^\circ$
 K. 25°



2



2

In the standard (x,y) coordinate plane, what is the slope of a line passing through the points $(-1,-8)$ and $(0,6)$?

DO YOUR FIGURING HERE.

- A. -14
- B. -2
- C. $\frac{1}{14}$
- D. 2
- E. 14

52. What is the degree measure of an angle that measures

$\frac{5\pi}{12}$ radians?

- F. 15°
- G. 75°
- H. 150°
- J. $\left(180 - \frac{5\pi}{12}\right)^\circ$
- K. $\left(\frac{360 - 5\pi}{12}\right)^\circ$

53. A circle in the standard (x,y) coordinate plane has its center at $(2,6)$ and an area of 4π square coordinate units. Which of the following is an equation for this circle?

- A. $(x-6)^2 - (y-2)^2 = 16$
- B. $(x-6)^2 + (y-2)^2 = 4$
- C. $(x-6)^2 + (y-2)^2 = 16$
- D. $(x-2)^2 + (y-6)^2 = 4$
- E. $(x-2)^2 + (y-6)^2 = 16$

54. Which of the following is FALSE for some x and y that satisfy the equation $x\left(\frac{1}{y}\right) = 1$?

- F. $y\left(\frac{1}{x}\right) = 1$
- G. $x = y$
- H. $x^2 + y^2 = 2xy$
- J. $x^2 = y^2$
- K. $x^5 + y^5 = 1$



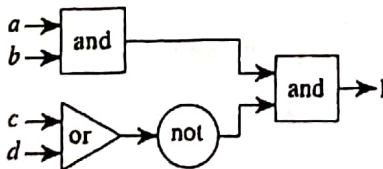
DO YOUR FIGURING HERE.

55. The 2×3 matrix $\begin{bmatrix} -2 & 1 & 3 \\ 1 & 2 & -2 \end{bmatrix}$ represents $\triangle ABC$ with vertices $A(-2,1)$, $B(1,2)$, and $C(3,-2)$ in the standard (x,y) coordinate plane. After a translation of $\triangle ABC$, the matrix representing the translated triangle is $\begin{bmatrix} -4 & -1 & 1 \\ 0 & 1 & k \end{bmatrix}$. What is the value of k ?
- A. -1
 - B. -2
 - C. -3
 - D. -4
 - E. -5

56. Three different logical operators are defined in the table below.

Symbol	Operator	Description
	AND	If both inputs are 1, then the output is 1. Otherwise, the output is 0.
	OR	If either input is 1 or if both inputs are 1, then the output is 1. Otherwise, the output is 0.
	NOT	If the input is 0, then the output is 1. Otherwise, the output is 0.

The logic diagram below uses the 3 operators. The only possible values for a , b , c , and d are 0 and 1. Which of the following (a,b,c,d) inputs will result in an output of 1?



- F. (0,1,0,0)
- G. (0,1,1,1)
- H. (1,0,1,0)
- J. (1,1,0,0)
- K. (1,1,0,1)



DO YOUR FIGURING HERE.

Whenever $b > 0$, which of the following real number line graphs represents the solutions for x to the inequality $|x + b| \geq 4$?

- A.
- B.
- C.
- D.
- E.

8. Whenever m and n are both integers, what is $(5.0 \times 10^m)(8.0 \times 10^n)$ expressed in scientific notation?

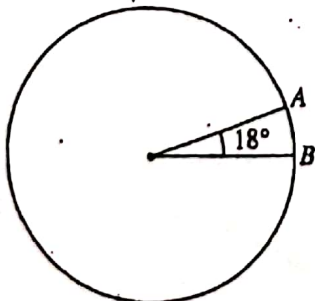
- F. 4.0×10^{mn}
- G. $4.0 \times 10^{m+n+1}$
- H. 40.0×10^{mn}
- J. $40.0 \times 10^{m^n}$
- K. 40.0×100^{mn}

59. The points A , B , C , and D lie in that order on a straight line. The midpoint of \overline{AC} is B , and the midpoint of \overline{AD} is C . The length of \overline{AB} is x inches, and the length of \overline{CD} is $3x - 6$ inches. What is the length, in inches, of \overline{AD} ?

- A. 24
- B. 16
- C. 12
- D. 8
- E. 6

60. The circle shown below has a radius of 10 cm. A central angle with measure 18° intercepts minor arc \overline{AB} . How many centimeters long is minor arc \overline{AB} ?

- F. $\frac{1}{10}\pi$
- G. $\frac{1}{5}\pi$
- H. π
- J. $\frac{100}{18}\pi$
- K. 180π



END OF TEST 2

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