



### 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. What is the perimeter, in centimeters, of a rectangle with length 14 cm and width 9 cm?
  - A. 23
  - B. 28
  - C. 46
  - D. 126
  - E. 252
  
2. The 1st term in the geometric sequence below is  $-4$ . If it can be determined, what is the 6th term?
 

$-4, 8, -16, 32, -64, \dots$

  - F. 128
  - G. 96
  - H.  $-96$
  - J.  $-128$
  - K. Cannot be determined from the given information
  
3. If  $r = 8$ ,  $b = 3$ , and  $g = -5$ , what does  $(r + b - g)(b + g)$  equal?
  - A.  $-32$
  - B.  $-12$
  - C. 12
  - D. 14
  - E. 32
  
4. Every year on Inari's birthday, her uncle gives her \$10, plus \$2 for each year of her age. How old will Inari be when she receives \$34 from her uncle on her birthday?
  - F. 7
  - G. 12
  - H. 14
  - J. 22
  - K. 29
  
5. For what value of  $x$  is the equation  $-2x + 3 = -21$  true?
  - A.  $-22$
  - B.  $-12$
  - C.  $-9$
  - D. 9
  - E. 12



6. What is the mean of the list of numbers below?

62, 100, 93, 62, 72, 78, 50, 85, 62, 36

- F. 62  
G. 64  
H. 67  
J. 70  
K. 75

DO YOUR FIGURING HERE.

7. Adam is baking a cake for his friend's birthday. The cake requires  $1\frac{2}{3}$  cups of cocoa, and the frosting requires  $\frac{3}{4}$  cup of cocoa. How many cups of cocoa does Adam need?

- A.  $1\frac{1}{12}$   
B.  $1\frac{1}{2}$   
C.  $1\frac{6}{7}$   
D.  $2\frac{2}{9}$   
E.  $2\frac{5}{12}$

8. In a level field, a vertical pole with a height of 6 feet casts a 10-foot shadow. At the same time, a tree growing in this field casts a 90-foot shadow. What is the height, in feet, of the tree?

- F. 9  
G. 15  
H. 54  
J. 60  
K. 150

9. The total cost of renting a car is \$35.00 for each day the car is rented plus 37.5¢ for each mile the car is driven. What is the total cost of renting the car for 4 days and driving 300 miles?

(Note: No sales tax is involved.)

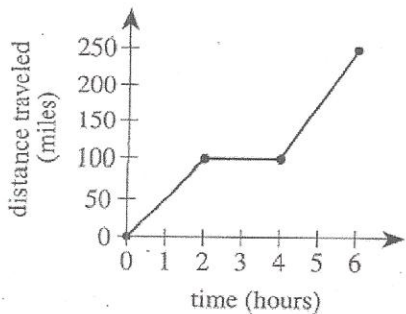
- A. \$ 116.50  
B. \$ 151.25  
C. \$ 252.50  
D. \$ 280.00  
E. \$1,265.00

10. The expression  $(7c - 2d)(2c + d)$  is equivalent to:

- F.  $14c^2 - 2d^2$   
G.  $14c^2 - 11cd - 2d^2$   
H.  $14c^2 - 11cd + 2d^2$   
J.  $14c^2 + 3cd - 2d^2$   
K.  $14c^2 + 3cd + 2d^2$

DO YOUR FIGURING HERE.

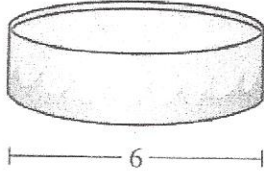
11. When solved for  $y$ , what is  $3x + 5y - 13 = 0$  ?
- A.  $y = \frac{-5x + 13}{3}$
  - B.  $y = \frac{-3x + 13}{5}$
  - C.  $y = \frac{3x + 13}{5}$
  - D.  $y = -3x - 8$
  - E.  $y = -15x - 65$
12. The speed of one bus exceeds 3 times the speed of another bus by 20 mph. The speed of the slower bus is  $k$  mph. Which of the following expressions represents the speed of the faster bus, in miles per hour?
- F.  $k + \frac{20}{3}$
  - G.  $k - 20$
  - H.  $k + 20$
  - J.  $3k - 20$
  - K.  $3k + 20$
13. At 2:00 a.m., the temperature is  $-15^{\circ}\text{F}$ . For the next 3 hours, the temperature decreases  $2^{\circ}\text{F}$  per hour. What is the temperature at 5:00 a.m. ?
- A.  $-21^{\circ}\text{F}$
  - B.  $-17^{\circ}\text{F}$
  - C.  $-15^{\circ}\text{F}$
  - D.  $-13^{\circ}\text{F}$
  - E.  $-9^{\circ}\text{F}$
14. Jing took 6 hours to travel 250 miles by car to Mirror Lake. The graph below shows the distance she traveled versus time. Among the following statements, which one best describes what happened during the interval between 2 hours and 4 hours?



- F. The car traveled at 50 mph.
- G. The car traveled 100 miles.
- H. The car traveled 200 miles.
- J. The car was stopped, and Jing had approximately 150 miles left to travel to Mirror Lake.
- K. The car was stopped, and Jing had approximately 100 miles left to travel to Mirror Lake.



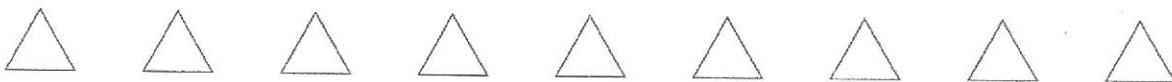
15. A children's wading pool, shown below, is in the shape of a right circular cylinder and has a diameter of 6 feet. The pool is filled to a uniform depth of 1.5 feet. Which of the following values is closest to the volume of water in the pool, in cubic feet?



(Note: The volume of a right circular cylinder is  $\pi r^2 h$ , where  $r$  is the radius of the cylinder and  $h$  is the height of the cylinder.)

- A. 28  
 B. 42  
 C. 57  
 D. 67  
 E. 133
16. For the function  $f(x) = |x|^3 - 1$ , what is the value of  $f(-1)$  ?
- F. 0  
 G. 1  
 H. 2  
 J. -4  
 K. -2
17. What is 125% of 332 ?
- A. 41.5  
 B. 265.6  
 C. 415  
 D. 4,150  
 E. 41,500
18.  $(6a + 5b + 4c) - (4a + 4b - 2c)$  is equivalent to:
- F.  $2a + b + 6c$   
 G.  $2a + b + 2c$   
 H.  $2a + 9b + 6c$   
 J.  $2a + 9b - 2c$   
 K.  $10abc$
19. In the standard  $(x,y)$  coordinate plane, the coordinates of the endpoints of  $\overline{GN}$  are  $(6,8)$  and  $(14,18)$ . What is the  $x$ -coordinate of the midpoint of  $\overline{GN}$  ?
- A. 7  
 B. 10  
 C. 13  
 D. 16  
 E. 20

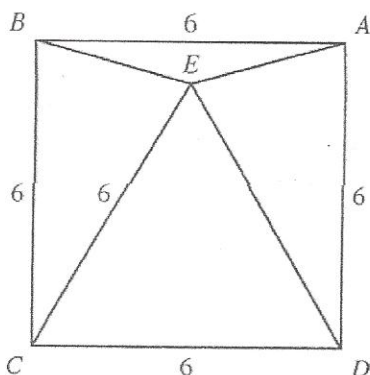
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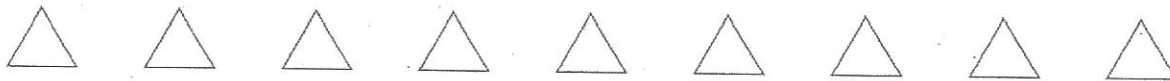
Use the following information to answer questions 20–22.

DO YOUR FIGURING HERE.

In the figure shown below, each side of square  $ABCD$  is 6 inches long. Point  $E$  lies inside the square, forming the equilateral triangle  $\triangle ECD$ .



20. What is the area, in square inches, of square  $ABCD$  ?
- F. 9  
G. 12  
H. 18  
J. 24  
K. 36
21. What is the measure of  $\angle BCE$  ?
- A.  $15^\circ$   
B.  $20^\circ$   
C.  $30^\circ$   
D.  $35^\circ$   
E.  $45^\circ$
22. The entire figure is placed in the standard  $(x,y)$  coordinate plane such that the vertices of the square are  $A(6,6)$ ,  $B(0,6)$ ,  $C(0,0)$ , and  $D(6,0)$ . The  $x$ -coordinate of  $E$  is 3. Which of the following is a line of symmetry for the figure?
- F.  $y=0$   
G.  $x=3$   
H.  $y=3$   
J.  $x=6$   
K.  $y=6$
- 
23. Beverly is using a punch recipe that calls for 2 parts ginger ale to 1 part fruit juice by volume. Beverly is planning to make 12 liters of this punch for a party. How many liters of fruit juice does Beverly need in order to make 12 liters of this punch?
- A. 1  
B. 3  
C. 4  
D. 6  
E. 8



24. What is the solution to the equation  $\frac{4c}{5} - \frac{1}{2} = -\frac{25}{2}$  ?

DO YOUR FIGURING HERE.

- F. -15
- G. -6
- H. -5
- J. 6
- K. 15

25. For the line segment below, the ratio of the length of  $\overline{AB}$  to the length of  $\overline{BC}$  is 1:4. If it can be determined, what is the ratio of the length of  $\overline{AB}$  to the length of  $\overline{AC}$  ?



- A. 1:3
- B. 1:5
- C. 4:1
- D. 5:1
- E. Cannot be determined from the given information

26. The line with equation  $8x + 3y = 5$  is graphed in the standard  $(x,y)$  coordinate plane. What is the slope of this line?

- F.  $-\frac{8}{3}$
- G.  $-\frac{3}{8}$
- H.  $\frac{8}{3}$
- J.  $\frac{3}{8}$
- K.  $\frac{5}{8}$

27. The Kingston High School multimedia room has 108 seats, which are all arranged in rows. The number of seats in each row is 3 less than the number of rows. How many rows of seats are in the multimedia room?

- A. 6
- B. 9
- C. 12
- D. 18
- E. 36

28. If  $90^\circ < \theta < 180^\circ$  and  $\sin \theta = \frac{10}{26}$ , then  $\cos \theta = ?$

- F.  $\frac{26}{10}$
- G.  $\frac{10}{24}$
- H.  $-\frac{24}{26}$
- J.  $-\frac{26}{24}$
- K.  $-\frac{26}{10}$



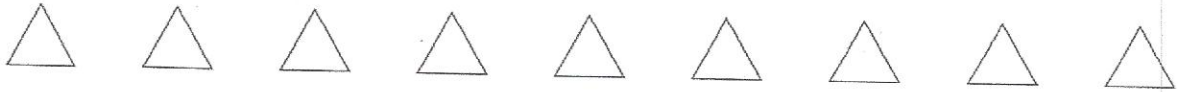
Use the following information to answer questions 29–32.

DO YOUR FIGURING HERE.

The table below gives the length and number of nails per pound for all types of nails available at Schulberg's Hardware. A 2-penny nail, for example, is represented in the "Nail type" column by the notation "2d." Nails bought at Schulberg's can be bought only in 1-pound packages. Each package contains only 1 type of nail.

Nail type	Length (inches)	Number of nails per 1 pound
2d	1.00	876
3d	1.25	568
4d	1.50	316
5d	1.75	271
6d	2.00	181
7d	2.25	161
8d	2.50	106
9d	2.75	96
10d	3.00	69
12d	3.25	64
16d	3.50	49
20d	4.00	31
30d	4.50	24
40d	5.00	18

29. For nails with lengths between 1.00 and 3.00 inches, which of the following expressions gives the length, in inches, of an  $n$ -penny nail?
- A.  $0.30n$   
 B.  $0.50n$   
 C.  $0.25n + 0.50$   
 D.  $n + 0.25$   
 E.  $2n - 3.00$
30. Hadji bought 1 package of 4d nails and 2 packages of 5d nails. These were the only nails he bought. What is the total number of nails that Hadji bought?
- F. 587  
 G. 858  
 H. 903  
 J. 2,619  
 K. 2,664
31. Ty bought an equal number of 12d, 30d, and 40d nails. What is the minimum number of nails of each size that Ty could have bought?
- A. 72  
 B. 120  
 C. 192  
 D. 432  
 E. 576



DO YOUR FIGURING HERE.

32. A salesperson gave Miki the following advice to determine the size of nail to use: The length of a nail should be 3 times the thickness of the board being fastened to a wall. According to this advice, what nail size should Miki use to fasten a 1.5-inch-thick board to a wall?
- F. 4d  
G. 8d  
H. 10d  
J. 12d  
K. 30d
- 
33. In the standard  $(x,y)$  coordinate plane, the equation of a circle is  $x^2 + y^2 = 100$ . At what 2 points does the circle intersect the  $y$ -axis?
- A.  $(0, 10)$  and  $(0, -10)$   
B.  $(0, 20)$  and  $(0, -20)$   
C.  $(0, 50)$  and  $(0, -50)$   
D.  $(0, 100)$  and  $(0, -100)$   
E.  $(0, 200)$  and  $(0, -200)$
34.  $(-mp)(mp^9)^4$  is equivalent to:
- F.  $m^4p^{36}$   
G.  $-m^4p^{36}$   
H.  $-m^5p^{37}$   
J.  $-m^8p^{40}$   
K.  $-m^{37}p^{37}$
35. The fraction  $\frac{578}{999}$  is equivalent to the repeating decimal  $0.\overline{578}$ . What is the 85th digit to the right of the decimal point?
- A. 5  
B. 6  
C. 7  
D. 8  
E. 9
36. A jar contains exactly 12 gumballs, each of which is a solid color. There are 5 blue and 7 white gumballs. Chris will draw one gumball at random and then, without replacement, will draw another gumball from the jar at random. Which of the following expressions gives the probability that Chris will draw 2 blue gumballs?
- F.  $\frac{5}{12} + \frac{5}{12}$   
G.  $\frac{5}{12} \cdot \frac{5}{12}$   
H.  $\frac{5}{12} \cdot \frac{4}{12}$   
J.  $\frac{5}{12} \cdot \frac{5}{11}$   
K.  $\frac{5}{12} \cdot \frac{4}{11}$



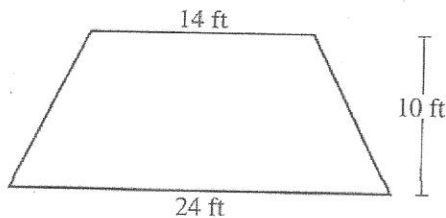


37. Jonah has 72 solid-colored disks that are either red, blue, or green. He lines them up on the floor and finds that there are 15 more red disks than green and 9 more green disks than blue. How many red disks does he have?

A. 13  
 B. 16  
 C. 22  
 D. 32  
 E. 37

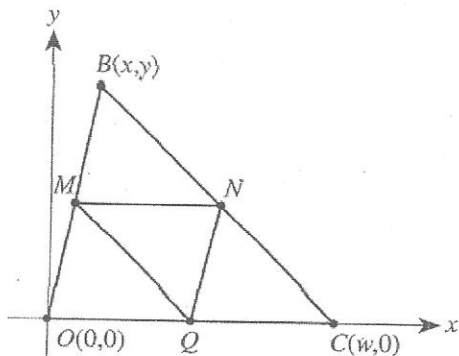
DO YOUR FIGURING HERE.

38. A contractor charges \$1.75 per square foot to waterproof the top surface of a wooden deck. What would be the contractor's charge for waterproofing the top surface of the trapezoid-shaped wooden deck shown below?



F. \$190.00  
 G. \$297.50  
 H. \$332.50  
 J. \$420.00  
 K. \$665.00

39. In  $\triangle OBC$  shown in the standard  $(x,y)$  coordinate plane below,  $M$  is the midpoint of  $\overline{OB}$ ,  $N$  is the midpoint of  $\overline{BC}$ , and  $Q$  is the midpoint of  $\overline{OC}$ . Which of the following statements is *always* true?



- A. The slope of  $\overline{MN}$  is equal to the slope of  $\overline{OC}$ .  
 B. The product of the slope of  $\overline{MN}$  and the slope of  $\overline{OC}$  is  $-1$ .  
 C. The product of the slope of  $\overline{MN}$  and the slope of  $\overline{OB}$  is  $-1$ .  
 D. The product of the slope of  $\overline{MN}$  and the slope of  $\overline{BC}$  is  $1$ .  
 E.  $\overline{MN} \cong \overline{OC}$



40. The junior class at Silverwood High School sponsored a costume party. Each student wearing a costume paid \$2 admission, and each student NOT wearing a costume paid \$5 admission. An amount of \$489 was collected from the 150 students who paid admission. How much of the amount was collected from students NOT wearing a costume?

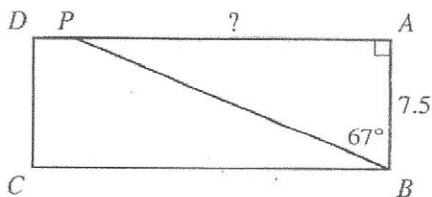
DO YOUR FIGURING HERE.

- F. \$245  
G. \$315  
H. \$349  
J. \$375  
K. \$435

41. Which of the following complex numbers is a sum of  $\sqrt{-48}$  and  $\sqrt{-27}$ ?

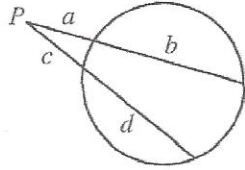
- A.  $-5\sqrt{3}$   
B.  $-7\sqrt{3}$   
C.  $5i\sqrt{3}$   
D.  $7i\sqrt{3}$   
E.  $25i\sqrt{3}$

42. Point  $P$  lies on side  $\overline{AD}$  of rectangle  $ABCD$  as shown below. The measure of  $\angle ABP$  is  $67^\circ$  and the length of  $\overline{AB}$  is 7.5 inches. Which of the following expressions is the length, in inches, of  $\overline{AP}$ ?



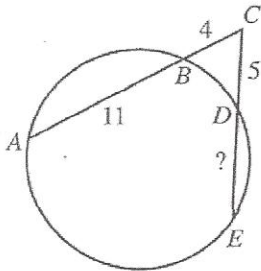
- F.  $7.5(\sqrt{3})$   
G.  $2(7.5)$   
H.  $\frac{7.5}{\sin 67^\circ}$   
J.  $\frac{7.5}{\cos 67^\circ}$   
K.  $7.5 \tan 67^\circ$

43. For any circle with 2 secants drawn from  $P$  to the circle, as shown in the figure below, the lengths of the segments of the secants are determined by  $a(a + b) = c(c + d)$ .

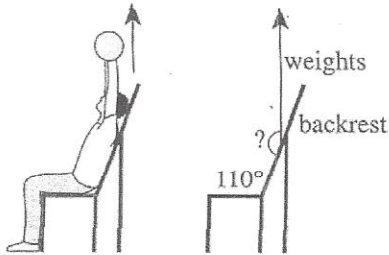


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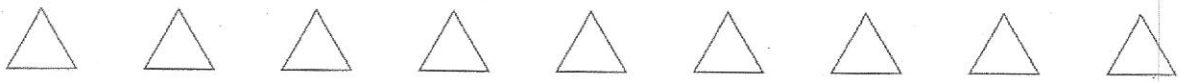
In the figure below,  $A, B, D,$  and  $E$  are on the circle. Point  $B$  is on secant segment  $\overline{AC}$ , and  $D$  is on secant segment  $\overline{CE}$ . The lengths of  $\overline{AB}, \overline{BC},$  and  $\overline{CD}$  are given in meters. What is the length, in meters, of  $\overline{DE}$ ?



- A. 6
  - B. 7
  - C. 9
  - D. 10
  - E. 12
44. While lifting weights, a person sits on an incline weight bench and pushes the weights straight up, as shown in the figure below on the left. The weight bench is shown below on the right. The angle between the horizontal seat and the backrest is  $110^\circ$ . What is the measure of the angle between the backrest and the vertical path of the weights?

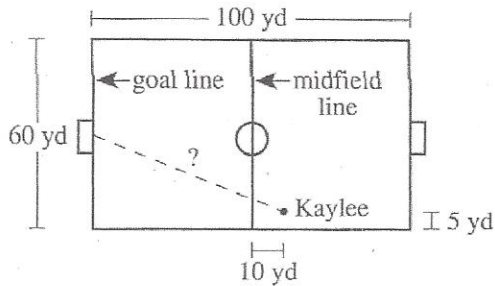


- F.  $70^\circ$
  - G.  $110^\circ$
  - H.  $130^\circ$
  - J.  $160^\circ$
  - K.  $250^\circ$
45. In the standard  $(x,y)$  coordinate plane, the graph of  $y = x^2$  is shifted 5 units down and 4 units right. Which of the following is an equation of the translated graph?
- A.  $y = (x + 4)^2 + 5$
  - B.  $y = (x + 4)^2 - 5$
  - C.  $y = (x - 4)^2 + 4$
  - D.  $y = (x - 4)^2 - 5$
  - E.  $y = (x + 5)^2 - 4$



46. When Kaylee kicked the winning soccer goal, she was 10 yards behind the midfield line and 5 yards from the sideline, as shown in the figure below. To the nearest yard, how far was Kaylee from the center of the goal line when she kicked the winning goal?

DO YOUR FIGURING HERE.



- F. 60  
G. 65  
H. 67  
J. 70  
K. 72
47. A sector of a circle has an area equal to  $\frac{5}{12}$  of the area of the circle. What is the measure of the sector's central angle?
- A.  $37.5^\circ$   
B.  $75^\circ$   
C.  $105^\circ$   
D.  $150^\circ$   
E.  $210^\circ$
48. List B consists of all the integers in List A below and also 3 integers  $a$ ,  $b$ , and  $c$ , where  $a \leq 17$ ,  $b = c$ , and  $b \geq 42$ . What is the median of the integers in List B?
- List A: 12, 16, 17, 29, 29, 35, 41, 42, 47, 47, 50
- F. 29  
G. 32  
H. 35  
J. 38  
K. 41
49. The solution set for the inequality  $|2x - a| \leq 3$  is  $\{x \mid 1 \leq x \leq 4\}$ . What is the value of  $a$ ?
- A. -1  
B.  $2\frac{1}{2}$   
C.  $3\frac{1}{2}$   
D. 5  
E. 11

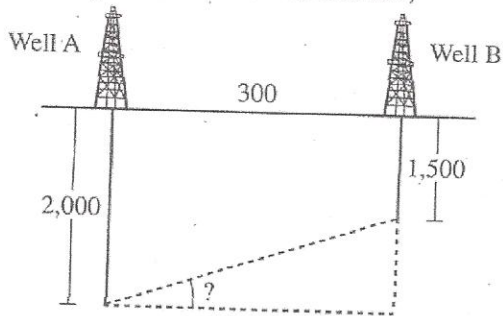
50. Which of the following is the least common denominator for the expression below?

DO YOUR FIGURING HERE.

$$\frac{1}{17 \cdot 23 \cdot 61^2} + \frac{1}{17^2 \cdot 23} + \frac{1}{17 \cdot 23^3}$$

- F.  $17 \cdot 23$
  - G.  $17 \cdot 23 \cdot 61$
  - H.  $17 \cdot 23 \cdot 61^2$
  - J.  $17^2 \cdot 23^3 \cdot 61^2$
  - K.  $17^4 \cdot 23^5 \cdot 61^2$
51. As shown in the figure below, the drill holes for Well A and Well B are 300 feet apart on level ground. Well A is dug straight down and reaches oil at 2,000 feet. Well B is dug straight down and reaches oil at 1,500 feet. What is the angle of elevation from the point where Well A reaches oil to the point where Well B reaches oil?

(Note: The figure is NOT drawn to scale.)



- A.  $\sin^{-1}\left(\frac{3}{5}\right)$
  - B.  $\cos^{-1}\left(\frac{3}{5}\right)$
  - C.  $\tan^{-1}\left(\frac{3}{5}\right)$
  - D.  $\cos^{-1}\left(\frac{5}{3}\right)$
  - E.  $\tan^{-1}\left(\frac{5}{3}\right)$
52. Tables of values for the 2 functions  $f$  and  $g$  are shown below. What is the value of  $g(f(5))$ ?

$x$	$f(x)$	$x$	$g(x)$
-6	8	-3	5
-3	-6	1	-1
-1	5	3	-5
5	3	5	-6

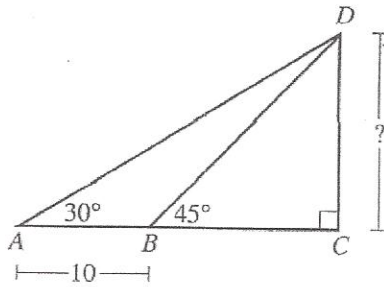
- F. -6
- G. -5
- H. 1
- J. 3
- K. 8



53. In the figure below,  $\triangle ACD$  is a right triangle,  $B$  lies on  $\overline{AC}$ , and the measures of  $\angle DAC$  and  $\angle DBC$  are given. The length of  $\overline{AB}$  is 10 yards. What is the approximate length, in yards, of  $\overline{CD}$ ?

DO YOUR FIGURING HERE.

- A. 3.7  
B. 4.1  
C. 13.7  
D. 15.7  
E. 24.1



54. For positive integers  $a$  and  $b$ , an operation  $\Delta$  can be defined by  $a \Delta b = \frac{a}{b} + \frac{b}{a}$ . When the sum of  $a$  and  $b$  is 5 and the product of  $a$  and  $b$  is 6, what is the value of  $a \Delta b$ ?

- F.  $\frac{5}{6}$   
G. 1  
H.  $\frac{5}{3}$   
J. 2  
K.  $\frac{13}{6}$

55. Given the matrix equation shown below, what is  $\frac{b}{a}$ ?

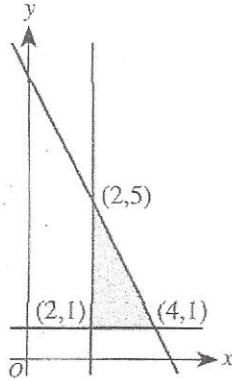
$$\begin{bmatrix} 3! \\ 2! \end{bmatrix} + \begin{bmatrix} 2! \\ 4! \end{bmatrix} = \begin{bmatrix} a \\ b \end{bmatrix}$$

(Note: Whenever  $n$  is a positive integer, the notation  $n!$  represents the product of the integers from  $n$  to 1. For example,  $3! = 3 \cdot 2 \cdot 1$ .)

- A.  $\frac{13}{4}$   
B.  $\frac{6}{5}$   
C.  $\frac{4}{7}$   
D. 4  
E. 6

DO YOUR FIGURING HERE.

56. Graphed in the standard  $(x,y)$  coordinate plane below is the solution set for a system of 3 linear inequalities. For values of  $x$  and  $y$  that satisfy this system, what is the maximum value of  $6x - 2y$ ?



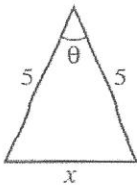
- F. 2
- G. 10
- H. 12
- J. 14
- K. 22

57. The square base of a regular pyramid has a side length of 4 inches. Each of the other 4 faces of the pyramid is a triangle with a base of 4 inches and a height of 6 inches. The pyramid has a total surface area of 64 square inches. A second regular pyramid has a square base that is 4 inches by 4 inches, but its total surface area is double that of the first pyramid. What is the height, in inches, of each of the triangular faces of the second pyramid?

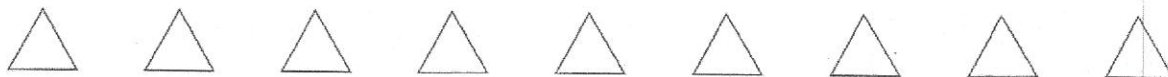
- A. 8
- B. 12
- C. 14
- D. 16
- E. 18

58. As shown in the figure below, a triangle has 2 sides each of length 5 feet and a 3rd side of length  $x$  feet. The degree measure of the angle between the 2 sides that are 5 feet long is  $\theta$ . In terms of  $x$ ,  $\cos \theta = ?$

(Note: For any triangle, if  $a$ ,  $b$ , and  $c$  are the lengths of the sides opposite  $\angle A$ ,  $\angle B$ , and  $\angle C$ , respectively, then  $a^2 = b^2 + c^2 - 2bc \cos \angle A$ .)

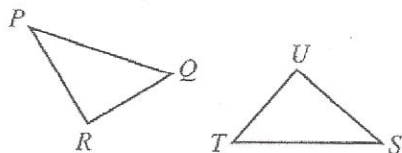


- F.  $\frac{x^2 + 50}{50}$
- G.  $\frac{x^2 - 50}{50}$
- H.  $\frac{x^2 - 10}{50}$
- J.  $\frac{50 - x^2}{50}$
- K.  $\frac{10 - x^2}{50}$



59. Which of the following diagrams provides information that is sufficient to prove that  $\triangle PQR$  and  $\triangle STU$ , shown below, are congruent?

DO YOUR FIGURING HERE.



- A.  $\angle P \cong \angle S$   
 $\angle Q \cong \angle T$   
 $\angle R \cong \angle U$
- B.  $\angle P \cong \angle S$   
 $\angle R \cong \angle T$   
 $\overline{PQ} \cong \overline{ST}$
- C.  $\angle P \cong \angle S$   
 $\overline{PQ} \cong \overline{ST}$   
 $\overline{QR} \cong \overline{TU}$
- D.  $\angle P \cong \angle S$   
 $\overline{PQ} \cong \overline{ST}$   
 $\overline{PR} \cong \overline{SU}$
- E.  $\angle P \cong \angle S$   
 $\overline{PR} \cong \overline{SU}$   
 $\overline{QR} \cong \overline{TU}$

60. What is the value of  $c$  if  $x+2$  is a factor of  $2x^3 + 2x^2 - 2cx + 4$ ?

- F. -4  
 G. -2  
 H. 0  
 J. 1  
 K. 7

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.