



### 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. If  $\frac{4}{y} = 0.4$ , then  $y = ?$

- A. 0.04
- B. 0.1
- C. 0.4
- D. 4
- E. 10

2. A motel manager's costs are 24% higher this year than they had been when the room rate was \$60.00. If the room rate had increased by the same percent as the manager's costs, what would the room rate be this year?

- F. \$68.40
- G. \$70.00
- H. \$72.00
- J. \$74.40
- K. \$78.95

3. Louis earns his regular pay of \$10.00 per hour for up to 40 hours of work in a week. For each hour over 40 hours of work in a week, Louis is paid  $1\frac{1}{2}$  times his regular pay. How much does Louis earn for a week in which he works 47 hours?

- A. \$470.00
- B. \$493.50
- C. \$505.00
- D. \$540.50
- E. \$705.00

4.  $3x^9 \cdot 5x^9$  is equivalent to:

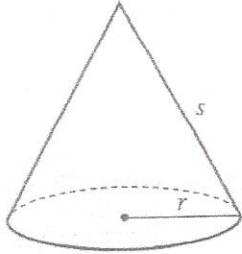
- F.  $8x^{18}$
- G.  $8x^{81}$
- H.  $15x^9$
- J.  $15x^{18}$
- K.  $15x^{81}$

**DO YOUR FIGURING HERE.**

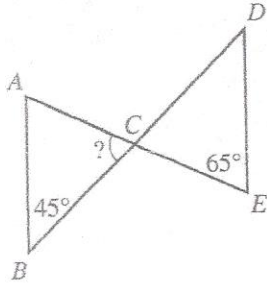


DO YOUR FIGURING HERE.

5. The total surface area,  $T$ , of any right circular cone with a radius  $r$  and a slant height  $s$ , such as the cone shown below, can be determined by using the formula  $T = \pi r^2 + \pi rs$ . If a cone has a 3-inch radius and a 5-inch slant height, what is its total surface area, in square inches?



- A.  $18\pi$   
 B.  $24\pi$   
 C.  $40\pi$   
 D.  $75\pi$   
 E.  $135\pi$
6. In the figure below,  $C$  lies on both  $\overline{AE}$  and  $\overline{BD}$ ,  $\overline{AB}$  and  $\overline{DE}$  are parallel and congruent, and 2 angle measures are given. What is the measure of  $\angle ACB$ ?



- F.  $55^\circ$   
 G.  $57.5^\circ$   
 H.  $65^\circ$   
 J.  $67.5^\circ$   
 K.  $70^\circ$

7. What is the least common denominator of the fractions

$$\frac{4}{35}, \frac{1}{28}, \text{ and } \frac{3}{8}?$$

- A. 40  
 B. 280  
 C. 980  
 D. 1,120  
 E. 7,840
8. Which of the following polynomial equations has solutions  $-2$  and  $5$ ?
- F.  $(x - 5)(x + 2)^2 = 0$   
 G.  $(x - 3)(x + 3)^2 = 0$   
 H.  $(x + 3)(x - 3)^2 = 0$   
 J.  $(x + 5)(x - 2)^2 = 0$   
 K.  $(x + 5)(x + 2)^2 = 0$



DO YOUR FIGURING HERE.

9. The combined length of 3 pieces of a board is 60 inches. The lengths of the pieces are in the ratio 3:5:7. What is the length, in inches, of the longest piece?
- A. 4  
B. 12  
C. 15  
D. 20  
E. 28
10. Zoe programs her calculator to evaluate a linear function, but she doesn't say what the function is. When 9 is entered, the calculator displays the value 6. When 12 is entered, the calculator displays the value 8. Which of the following expressions represents what the calculator will display when any number,  $n$ , is entered?
- F.  $\frac{2}{3}n$   
G.  $\frac{3}{2}n$   
H.  $n - 3$   
J.  $n - 4$   
K.  $\frac{3}{2}n - \frac{15}{2}$
11. Points  $C(2,5)$  and  $D(8,11)$  lie in the standard  $(x,y)$  coordinate plane. What is the midpoint of  $\overline{CD}$ ?
- A. (3,8)  
B. (5,6)  
C. (5,8)  
D. (6,6)  
E. (6,8)
12. A rectangular box that is  $\frac{1}{9}$  foot deep, 1 foot wide, and 1 foot long has a volume of how many cubic feet?
- F.  $\frac{1}{9}$   
G. 1  
H.  $2\frac{1}{9}$   
J. 9  
K. 81

**2****2**

13. Which of the following expressions is equal to  $(3x^2 - 4x - 5) - (-x^2 + 6x + 7)$  for all real values of  $x$ ?

- A.  $2x^2 - 10x - 12$
- B.  $2x^2 - 10x + 2$
- C.  $4x^2 - 10x - 12$
- D.  $4x^2 - 10x + 2$
- E.  $4x^2 + 2x + 2$

**DO YOUR FIGURING HERE.**

14. For all positive integers  $a$ , let  $E$  represent the sentence " $a$  is even" and let  $P$  represent the sentence " $a$  is prime." When  $a = 22$ , which of the following statements is true?

- F. Both  $E$  and  $P$  are true.
- G. If  $E$  is true, then  $P$  is true.
- H.  $E$  is true and  $P$  is false.
- J.  $P$  is true and  $E$  is false.
- K. Both  $E$  and  $P$  are false.

15.  $|6(-7) + 4(8)| = ?$

- A. -144
- B. -10
- C. 10
- D. 74
- E. 144

16. In the standard  $(x,y)$  coordinate plane, what is the slope of the line  $11x + 6y = 3$ ?

- F. -11
- G.  $-\frac{11}{6}$
- H.  $\frac{11}{3}$
- J. 3
- K. 11

17. A function  $g$  is defined as  $g(x,y,z) = 4xy - 3xz^2$ . What is  $g(2,4,-3)$ ?

- A. -22
- B. -4
- C. 8
- D. 68
- E. 86





DO YOUR FIGURING HERE.

Use the following information to answer questions 18–21.

A family plans to remodel their kitchen. They have a total budget of \$45,000 to cover expenses in 6 categories. Not all the budget has been assigned. The budget amounts that have been assigned are shown in the table below.

Expense category	Budget amount
Appliances	\$ 4,000
Cabinets	\$ 9,000
Flooring	\$ 5,000
Lighting	\$ 3,000
Labor	?
Other	?
Total budget	\$45,000

18. In a circle graph illustrating the 6 budget amounts in the table, what should be the measure of the central angle of the Flooring sector?
- F.  $24^\circ$   
 G.  $32^\circ$   
 H.  $40^\circ$   
 J.  $45^\circ$   
 K.  $72^\circ$
19. The amount budgeted for Appliances is the sum of the prices of 5 appliances—1 refrigerator, 1 dishwasher, 1 built-in cooktop, and 2 ovens (1 conventional and 1 microwave). What is the average price per appliance?
- A. \$ 800  
 B. \$1,000  
 C. \$1,250  
 D. \$1,800  
 E. \$2,250
20. Suppose a bar graph will be constructed illustrating the amounts of the assigned expenses. The length of the bar for Lighting should be what fraction of the length of the bar for Cabinets?
- F.  $\frac{1}{15}$   
 G.  $\frac{1}{5}$   
 H.  $\frac{1}{3}$   
 J.  $\frac{3}{5}$   
 K.  $\frac{3}{4}$

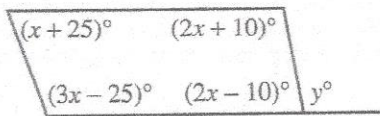


21. Which of the following percents is closest to the percent of the total budget that remains to be assigned?

A. 21%  
 B. 24%  
 C. 40%  
 D. 47%  
 E. 53%

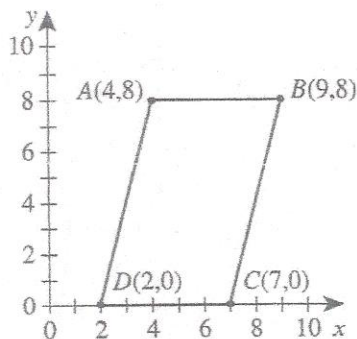
DO YOUR FIGURING HERE.

22. In the figure below, 5 angle measures are given. The angle marked with a measure of  $y^\circ$  is an exterior angle. What is the value of  $y$ ?



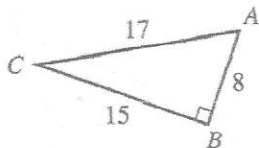
F. 22.5  
 G. 45  
 H. 80  
 J. 100  
 K. 145

23. What is the area, in square coordinate units, of parallelogram  $ABCD$  shown in the standard  $(x,y)$  coordinate plane below?

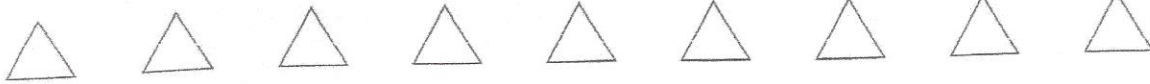


A. 14  
 B. 16  
 C. 28  
 D. 40  
 E. 45

24. Right triangle  $\triangle ABC$  is shown below. The side lengths are given in centimeters. What is  $\tan C$ ?



F.  $\frac{8}{17}$   
 G.  $\frac{8}{15}$   
 H.  $\frac{15}{17}$   
 J.  $\frac{15}{8}$   
 K.  $\frac{17}{8}$



DO YOUR FIGURING HERE.

25. The system of equations below has 1 solution  $(a,b)$ .  
What is the value of  $b$ ?

$$\begin{aligned} 3a - 5b &= 22 \\ a + 3b &= -2 \end{aligned}$$

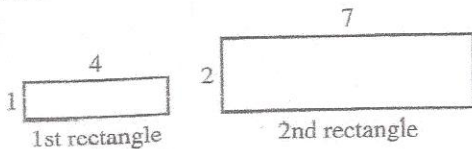
- A. -4  
B. -2  
C. 4  
D. 9  
E. 20
26. For his job delivering pizzas, Albert uses his own car and buys his own gas. He joined the local gas station's Frequent Fueler program that earns him points toward free gas each time he buys gas. Points are earned according to the following chart.

Frequent Fueler Program:

Sign up for the program, earn	50 points
Buy 1 gallon regular, earn	3 points
Buy 1 gallon premium, earn	4 points

At the end of his first month in the program, he received a statement showing that he had 545 points (including 50 points he received for signing up) and had purchased a total of 135 gallons of gas. To find how many gallons of premium he had purchased, he solved a system of equations with  $r$  representing the number of gallons of regular and  $p$  representing the number of gallons of premium. One equation in his system was  $r + p = 135$ . Which of the following could have been his other equation?

- F.  $3r + 4p = 495$   
G.  $3r + 4p = 595$   
H.  $4r + 3p = 495$   
J.  $4r + 3p = 545$   
K.  $4r + 3p = 595$
27. The first 2 rectangles of a sequence of rectangles are shown below. The 1st rectangle is 4 inches long and 1 inch wide. The dimensions of the 2nd rectangle, and of each successive rectangle after the 2nd, are determined by continuing the following pattern: the length is 3 inches longer than the length of the previous rectangle, and the width is 1 inch longer than the width of the previous rectangle. What is the perimeter, in inches, of the 6th rectangle in the sequence?



- A. 24  
B. 40  
C. 50  
D. 56  
E. 60





28. Which of the expressions below is a factor of the polynomial  $2x^3 + x^2 - 6x$ ?

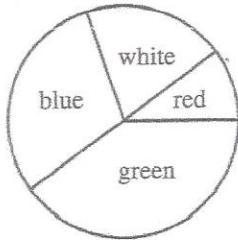
- I.  $x$   
 II.  $2x + 3$   
 III.  $x - 2$

- F. I only  
 G. I and II only  
 H. I and III only  
 J. II and III only  
 K. I, II, and III

DO YOUR FIGURING HERE.

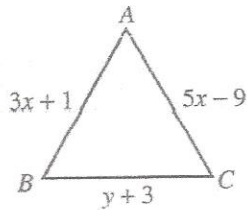
29. Shown below, a circular dartboard has 4 sectors (red, white, blue, and green) whose areas are in the ratio of 1:2:3:4, respectively. Brad will throw 1 dart at the dartboard, and it will hit the dartboard at a random point contained in 1 of the sectors. What is the probability that the sector the dart hits is NOT the blue sector?

- A.  $\frac{3}{10}$   
 B.  $\frac{4}{10}$   
 C.  $\frac{5}{10}$   
 D.  $\frac{6}{10}$   
 E.  $\frac{7}{10}$



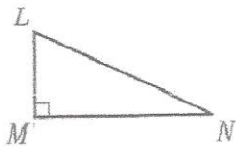
30. The dimensions of equilateral triangle  $\triangle ABC$  are given in centimeters in the figure below. What is the value of  $y$ ?

- F. 2  
 G. 5  
 H. 8  
 J. 13  
 K. 16



31. For right triangle  $\triangle LMN$  below,  $\cos L = \frac{7}{16}$ . What is  $\sin N$ ?

- A.  $\frac{7}{9}$   
 B.  $\frac{7}{\sqrt{207}}$   
 C.  $\frac{7}{16}$   
 D.  $\frac{9}{\sqrt{207}}$   
 E.  $\frac{9}{16}$







DO YOUR FIGURING HERE.

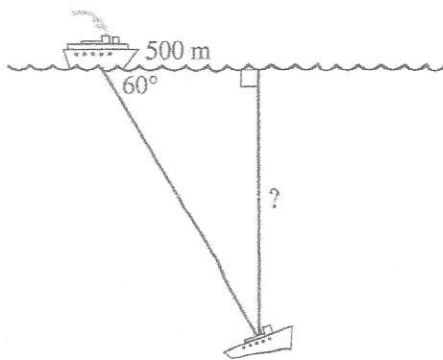
32. When a store sets the price of birdseed at \$3.50 per pound, the store sells 2,500 pounds of birdseed per week. With each \$0.25 increase in the \$3.50 price per pound, the store sells 100 pounds less birdseed per week. Let  $n$  be the number of \$0.25 increases in the price per pound. Which of the following expressions best represents the dollar amount of the store's weekly sales of birdseed?

- F.  $(3.75)(2,500 + 100n)$   
 G.  $(3.75)(2,500 - 100n)$   
 H.  $(2,500 + 0.25n)(100 + 3.50n)$   
 J.  $(3.50 + 0.25n)(2,500 + 100n)$   
 K.  $(3.50 + 0.25n)(2,500 - 100n)$

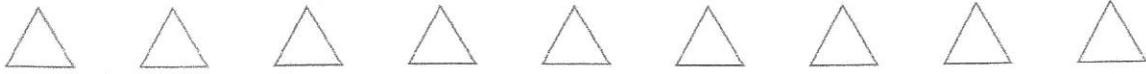
33. The circumference of a circle is 20 cm. What is the length, in centimeters, of the *radius* of the circle?

- A.  $\pi$   
 B.  $\frac{10}{\pi}$   
 C.  $\frac{20}{\pi}$   
 D. 20  
 E.  $20\pi$

34. You're on a salvage ship in the Pacific Ocean when your ship's sonar locates a shipwreck at an angle of depression of  $60^\circ$ , as shown in the figure below. After your ship travels 500 meters on the surface of the water to be directly over the wreck, how many meters down would you have to dive to reach the wreck?



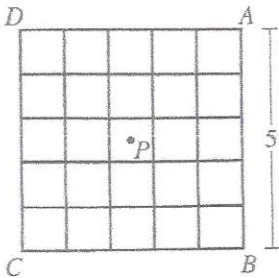
- F.  $\frac{500}{\sqrt{3}}$   
 G. 500  
 H. 1,000  
 J.  $500\sqrt{2}$   
 K.  $500\sqrt{3}$



Use the following information to answer questions 35–38.

DO YOUR FIGURING HERE.

Square  $ABCD$ , shown below, has side length 5 meters. The square is divided into 25 nonoverlapping congruent squares. Point  $P$  is the center of  $ABCD$ .



35. What is the length, in meters, of  $\overline{AC}$  ?
- A.  $2\sqrt{5}$   
 B. 5  
 C.  $5\sqrt{2}$   
 D. 20  
 E. 25
36. The perimeter of 1 of the 25 congruent squares is how many meters?
- F. 1  
 G. 4  
 H. 5  
 J. 20  
 K. 25
37. Point  $M$  starts at  $A$  and is rotated counterclockwise ( $\curvearrowright$ ) about  $P$  a total of  $450^\circ$ . After the rotation,  $M$  is at the same location as which of the following points?
- A.  $A$   
 B.  $B$   
 C.  $C$   
 D.  $D$   
 E.  $P$
38. Suppose  $ABCD$  is in the standard  $(x,y)$  coordinate plane such that  $\overline{BC}$  is on the  $x$ -axis, the midpoint of  $\overline{BC}$  is at the origin,  $A$  has positive coordinates, and 1 coordinate unit is equal to 1 meter. What are the coordinates of  $D$  ?
- F.  $(-5,5)$   
 G.  $(-2.5,0)$   
 H.  $(-2.5,2.5)$   
 J.  $(-2.5,5)$   
 K.  $(0,5)$



DO YOUR FIGURING HERE.

39. For what value of  $x$  is the equation  $\sqrt[3]{3x-9} + 10 = 13$  true?

- A. 4
- B. 6
- C. 12
- D. 576
- E.  $4,058\frac{2}{3}$

40. Ten years ago, Tara invested \$2,000 at 6% interest compounded monthly. Which of the following expressions represents today's value of the investment?

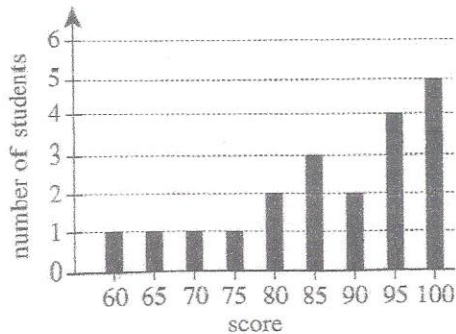
- F.  $\$2,000e^{0.6}$
- G.  $\$2,000(1 + 0.06)^{10}$
- H.  $\$2,000\left(1 + \frac{0.06}{4}\right)^{40}$
- J.  $\$2,000\left(1 + \frac{0.06}{12}\right)^{120}$
- K.  $\$2,000 + \$2,000(0.06)(10)$

41. Which of the following is the decimal equivalent to  $\frac{2}{7}$ ?

(Note: A bar indicates a digit pattern that is repeated.)

- A.  $0.\overline{285714}$
- B. 0.28571428
- C.  $0.285714\overline{28}$
- D. 0.2857142857
- E.  $0.285714\overline{2857}$

42. Ms. Simons made a bar graph of the 20 scores on the last math test, as shown below. Which of the following statements about the mean of the 20 scores is true?



- F. The mean is less than 75.
- G. The mean is 75.
- H. The mean is between 75 and 85.
- J. The mean is 85.
- K. The mean is greater than 85.



DO YOUR FIGURING HERE.

43. To plan orders for a party, a caterer uses the formula  $P = \frac{64G}{S}$ , where  $P$  is the number of people,  $G$  is the number of gallons of punch, and  $S$  is the size of the cups in ounces. Which of the following gives the number of gallons of punch to order for a party of 200 people when 5-ounce cups will be used?

- A.  $\frac{(5)(64)}{200}$
- B.  $\frac{(5)(200)}{64}$
- C.  $\frac{(64)(200)}{5}$
- D.  $\frac{64}{(5)(200)}$
- E.  $\frac{200}{(5)(64)}$

44. Linh has \$3.67 in quarters (\$0.25), dimes (\$0.10), nickels (\$0.05), and pennies (\$0.01). She arranges these coins in rows and notices that there are 5 more dimes than quarters, 1 more nickel than quarters, and 25 more pennies than quarters. How many pennies does Linh have?

- F. 7
- G. 12
- H. 25
- J. 31
- K. 32

45. Consider the transformation of the standard  $(x,y)$  coordinate plane that maps each point  $(x,y)$  to the point  $(kx,ky)$  for a certain positive constant,  $k$ . In particular, this transformation maps  $(3,9)$  to  $(1,3)$ . This transformation maps  $(9,24)$  to which of the following points?

- A. ( 3, 8)
- B. ( 6,21)
- C. ( 7,18)
- D. (11,30)
- E. (27,72)

46. Lindsay is designing a 5-foot-by-8-foot rectangular poster for her art class. She will cover both diagonals of the poster with straight lengths of yellow rope. Which of the following values is closest to the total length, in feet, of the 2 yellow ropes Lindsay will need for the poster?

- F. 19
- G. 20
- H. 23
- J. 26
- K. 40





DO YOUR FIGURING HERE.

47. Robert writes a check for \$20. When he records the check in his check register, he accidentally *adds* \$20 to his balance instead of subtracting \$20, which causes a discrepancy between what Robert's check register shows and what it should show. Because of his mistake, Robert's check register shows:

- A. \$40 less than it should.
- B. \$20 less than it should.
- C. \$10 more than it should.
- D. \$20 more than it should.
- E. \$40 more than it should.

48. For a certain location in Grand Canyon National Park, the highest temperature on record is  $120^{\circ}\text{F}$  and the lowest temperature on record is  $-18^{\circ}\text{F}$ . Which of the statements below is necessarily true about the temperatures on record for this location?

- I. The range of temperatures is  $138^{\circ}\text{F}$ .
- II. The range of temperatures is  $102^{\circ}\text{F}$ .
- III. The median temperature is  $69^{\circ}\text{F}$ .

- F. I only
- G. II only
- H. III only
- J. I and III only
- K. II and III only

49. The graph of  $y = \frac{2x-5}{x+3}$  in the standard  $(x,y)$  coordinate plane has a vertical asymptote with equation  $x = ?$

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

50. What fraction of a 6-inch-diameter pizza contains the same amount of pizza as 1 slice of a 12-inch-diameter pizza of the same thickness cut into 12 equal slices?

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

51. For what real value of  $x$  is  $\frac{3^x 3^4}{(3^4)^5} = \frac{1}{9}$  true?

- A. 3
- B. 5
- C. 11
- D. 14
- E. 16

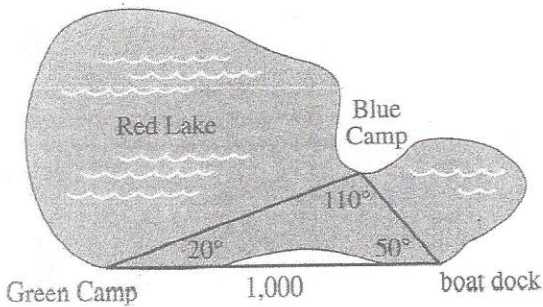


52. What are all real values of  $m$ , if any, such that any line through the points  $(3,7)$  and  $(3,m)$  will be vertical when graphed in the standard  $(x,y)$  coordinate plane?

F.  $-7$   
 G.  $3$   
 H. All real numbers satisfy this condition.  
 J. All real numbers except  $7$  satisfy this condition.  
 K. No real numbers satisfy this condition.

DO YOUR FIGURING HERE.

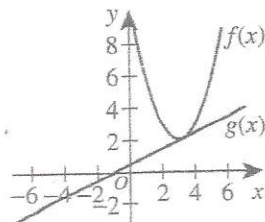
53. Green Camp and Blue Camp lie on opposite sides of Red Lake. A boat dock is located 1,000 yards from Green Camp. The campers estimated the angles between these 3 locations to be as shown on the map below. Using these estimates, which of the following expressions gives the distance, in yards, between Green Camp and Blue Camp?



- A.  $\frac{5,000}{11}$   
 B.  $\frac{1,000}{\cos 20^\circ}$   
 C.  $\frac{1,000}{\sin 110^\circ}$   
 D.  $\frac{1,000 \sin 50^\circ}{\sin 110^\circ}$   
 E.  $1,000 \tan 50^\circ$

54. The graphs of the functions  $y = f(x) = (x - 3)^2 + 2$  and  $y = g(x) = \frac{1}{2}x + \frac{1}{2}$  are shown in the standard  $(x,y)$  coordinate plane below. Which of the following is NOT true?

- F.  $|f(x)| = f(x)$   
 G.  $|g(x)| = g(x)$   
 H.  $f(3) = g(3)$   
 J.  $f(3\frac{1}{2}) = g(3\frac{1}{2})$   
 K.  $f(g(1)) = 6$



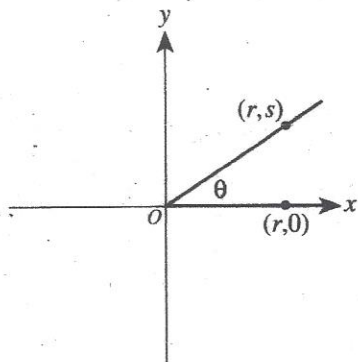


55. When  $3 \leq x \leq 5$  and  $7 \leq y \leq 9$ , the smallest possible value for  $\frac{2}{y-x}$  is:

- A.  $\frac{7}{9}$   
 B.  $\frac{1}{6}$   
 C.  $\frac{1}{4}$   
 D.  $\frac{1}{3}$   
 E.  $\frac{1}{2}$

DO YOUR FIGURING HERE.

56. In the standard  $(x,y)$  coordinate plane below,  $\theta$  is the radian measure of any angle in standard position with the point  $(r,s)$  on the terminal side. Which of the following points is on the terminal side of the angle in standard position having radian measure  $\pi - \theta$ ?



- F.  $(-r, s)$   
 G.  $(r, -s)$   
 H.  $(-s, -r)$   
 J.  $(-s, r)$   
 K.  $(s, -r)$

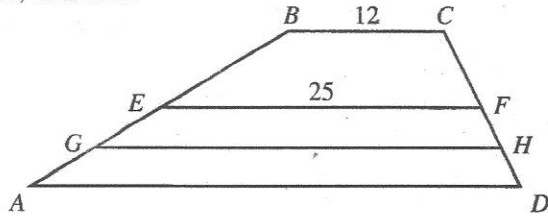
57. Which of the following matrices is equal to the matrix product  $\begin{bmatrix} 2 & -5 \\ -3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ ?

- A.  $\begin{bmatrix} 4 & 5 \\ -6 & -4 \end{bmatrix}$   
 B.  $\begin{bmatrix} 4 & -3 \\ -4 & 3 \end{bmatrix}$   
 C.  $\begin{bmatrix} 4 & -10 \\ 3 & -4 \end{bmatrix}$   
 D.  $\begin{bmatrix} -1 \\ -2 \end{bmatrix}$   
 E.  $\begin{bmatrix} 9 \\ -10 \end{bmatrix}$





58. In the figure below,  $\overline{BC}$  is parallel to  $\overline{AD}$ ,  $E$  is the midpoint of  $\overline{AB}$ ,  $F$  is the midpoint of  $\overline{CD}$ ,  $G$  is the midpoint of  $\overline{AE}$ , and  $H$  is the midpoint of  $\overline{FD}$ . The lengths marked are in inches. What is the length of  $\overline{GH}$ , in inches?



DO YOUR FIGURING HERE.

- F. 31  
 G.  $31\frac{1}{2}$   
 H. 37  
 J. 38  
 K.  $43\frac{1}{2}$
59. Suppose that  $a$  will be randomly selected from the set  $\{-3, -2, -1, 0, 1\}$  and that  $b$  will be randomly selected from the set  $\{-2, -1, 0, 1\}$ . What is the probability that  $ab > 0$ ?
- A.  $\frac{3}{200}$   
 B.  $\frac{1}{20}$   
 C.  $\frac{3}{10}$   
 D.  $\frac{7}{20}$   
 E.  $\frac{3}{5}$
60. Distinct points  $A, B, C,$  and  $D$  are collinear, and  $B$  is between  $A$  and  $C$ . For  $D$  to be between  $A$  and  $C$  such that  $AD + DB + BC = AC$ , which of statements I–IV below *must* be true?  
 (Note: If  $B$  is between  $A$  and  $C$ , then  $AB + BC = AC$ .)
- I.  $AD = DB$   
 II.  $AD = BC$   
 III.  $B$  is between  $D$  and  $C$   
 IV.  $D$  is between  $B$  and  $C$
- F. I only  
 G. III only  
 H. I and III only  
 J. II and IV only  
 K. None of the statements must be true.

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.