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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. A restaurant occupying the top floor of a skyscraper rotates as diners enjoy the view. Ling and Sarah notice that they began their meal at 7:00 p.m. looking due north. At 7:45 p.m. they had rotated 180° to a view that was due south. At this rate, how many degrees will the restaurant rotate in 1 hour?

- A. 90°
- B. 180°
- C. 240°
- D. 270°
- E. 400°

DO YOUR FIGURING HERE.

2. The cost of a gym membership is a onetime fee of \$140, plus a monthly fee of \$40. Brendan wrote a \$500 check to pay his gym membership for a certain number of months, including the onetime fee. How many months of membership did he pay for?

- F. 3
- G. 4
- H. 9
- J. 12
- K. 13

3. A museum offers a 2-hour guided group tour. For groups with fewer than 25 people the cost is \$9.25 per person; for groups with 25 people or more the cost is \$8.50 per person. The 27 people in the 9:00 a.m. tour group each paid \$9.25 in advance. What is the total refund that the museum owes the 9:00 a.m. group?

- A. \$12.50
- B. \$13.00
- C. \$18.75
- D. \$20.25
- E. \$25.00

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DO YOUR FIGURING HERE.

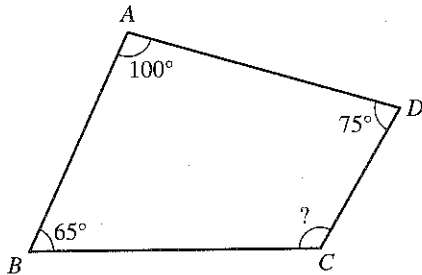
4. The 13-member math club needs to choose a student government representative. They decide that the representative, who will be chosen at random, CANNOT be any of the 3 officers of the club. What is the probability that Samara, who is a member of the club but NOT an officer, will be chosen?

- F. 0
- G. $\frac{1}{13}$
- H. $\frac{1}{10}$
- J. $\frac{3}{13}$
- K. $\frac{1}{3}$

5. Mele earned scores of 75, 70, 92, 95, and 97 points (a total of 429 points) on the first 5 tests in Economics II. Solving which of the following equations for s gives the score he needs to earn on the 6th test to average exactly 85 points for all 6 tests?

- A. $\frac{429}{5} + s = 85$
- B. $\frac{429}{6} + s = 85$
- C. $\frac{s + 429}{5} = 85$
- D. $\frac{s + 429}{6} = 85$
- E. $\frac{s + 429}{6} = \frac{85}{100}$

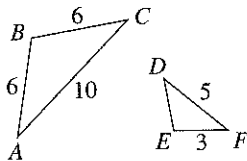
6. The figure below shows quadrilateral $ABCD$. What is the measure of $\angle C$?



- F. 120°
- G. 115°
- H. 105°
- J. 100°
- K. 80°

7. In the figure below, $\triangle ABC$ and $\triangle DEF$ are similar triangles with the given side lengths in meters. What is the perimeter, in meters, of $\triangle DEF$?

- A. 3
- B. 8
- C. 11
- D. 12
- E. 13



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8. $|3(-2) + 4| = ?$

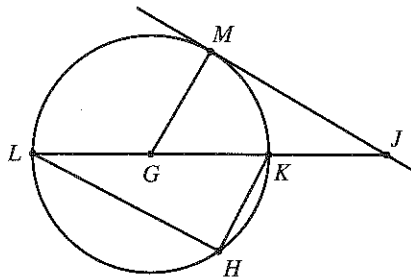
- F. -2
- G. 2
- H. 5
- J. 9
- K. 10

DO YOUR FIGURING HERE.

9. What are the values for x that satisfy the equation $(x + a)(x + b) = 0$?

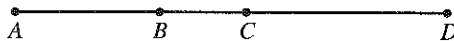
- A. $-a$ and $-b$
- B. $-a$ and b
- C. $-ab$
- D. a and $-b$
- E. a and b

10. In the figure below, G is the center of the circle, \overline{LK} is a diameter, H lies on the circle, J lies outside the circle on \overleftrightarrow{LK} , and \overleftrightarrow{JM} is tangent to the circle at M . Which of the following angles or minor arcs has the greatest degree measure?



- F. \widehat{LM}
- G. \widehat{MK}
- H. $\angle JMG$
- J. $\angle LHK$
- K. $\angle MJL$

11. Points B and C lie on \overline{AD} as shown below. The length of \overline{AD} is 30 units; \overline{AC} is 16 units long; and \overline{BD} is 20 units long. How many units long, if it can be determined, is \overline{BC} ?



- A. 4
 - B. 6
 - C. 10
 - D. 14
 - E. Cannot be determined from the given information
12. If $12x = -8(10 - x)$, then $x = ?$
- F. 20
 - G. 8
 - H. $7\frac{3}{11}$
 - J. $6\frac{2}{13}$
 - K. -20

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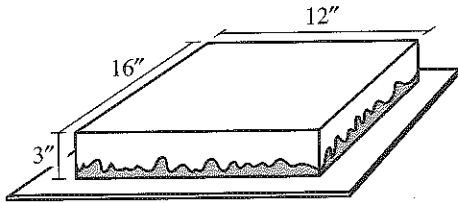


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DO YOUR FIGURING HERE.

Use the following information to answer questions 13–15.

Ken baked, frosted, and decorated a rectangular cake for the last Math Club meeting. The cake was 3 inches high, 12 inches wide, and 16 inches long. He centered the cake on a piece of cardboard whose rectangular top surface had been covered with aluminum foil, as shown in the figure below.



13. Ken used a piece of cardboard large enough to allow the cardboard to extend 2 inches beyond the cake on all sides. What is the area, in square inches, of the aluminum foil that is exposed on the top surface of the cardboard?
- A. 60
B. 64
C. 88
D. 96
E. 128
14. At the Math Club meeting, Principal Gonzales cut the entire cake into pieces. Each piece is 2 inches wide, 2 inches long, and 3 inches high. What is the number of pieces Principal Gonzales cut the cake into?
- F. 16
G. 20
H. 28
J. 48
K. 96
15. The Math Club will pay Ken \$5.00 for preparing the cake and will also pay him for the cost of the cake mix at \$1.73, the frosting mix at \$2.67, and the sales tax of 5% on these 2 items. What is the total amount the Math Club will pay Ken?
- A. \$4.67
B. \$9.40
C. \$9.45
D. \$9.62
E. \$9.87

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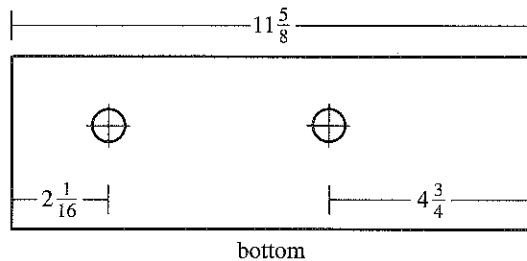


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16. What is the y -intercept of the line in the standard (x,y) coordinate plane that goes through the points $(-3,6)$ and $(3,2)$?
- F. 0
 - G. 2
 - H. 4
 - J. 6
 - K. 8

DO YOUR FIGURING HERE.

17. A machine part is diagrammed in the figure below with the dimensions given in inches. If the centers of the circles lie on the same line parallel to the bottom of the part, what is the distance, in inches, between the centers of the 2 holes in the machine part?



- A. $5\frac{3}{16}$
 - B. $5\frac{1}{16}$
 - C. 5
 - D. $4\frac{13}{16}$
 - E. $4\frac{3}{16}$
18. The depth of a pond is 180 cm and is being reduced by 1 cm per week. The depth of a second pond is 160 cm and is being reduced by $\frac{1}{2}$ cm per week. If the depths of both ponds continue to be reduced at these constant rates, in about how many weeks will the ponds have the same depth?
- F. 10
 - G. 20
 - H. 40
 - J. 80
 - K. 140

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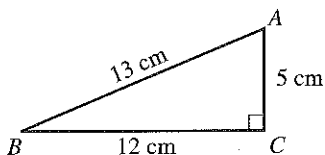
19. When graphed in the standard (x,y) coordinate plane, which of the following equations does NOT represent a line?

DO YOUR FIGURING HERE.

- A. $x = 4$
- B. $3y = 6$
- C. $x - y = 1$
- D. $y = \frac{3}{4}x - 2$
- E. $x^2 + y = 5$

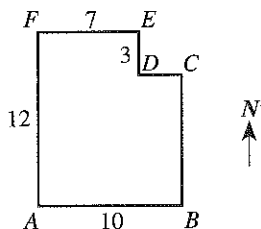
20. In the right triangle shown below, which of the following statements is true about $\angle A$?

- F. $\cos A = \frac{12}{13}$
- G. $\sin A = \frac{12}{13}$
- H. $\tan A = \frac{12}{13}$
- J. $\cos A = \frac{13}{12}$
- K. $\sin A = \frac{13}{12}$



21. A park has the shape and dimensions in blocks given below. A water fountain is located halfway between point B and point D . Which of the following is the location of the water fountain from point A ?

(Note: The park's borders run east-west or north-south.)



- A. $3\frac{1}{2}$ blocks east and 6 blocks north
- B. 5 blocks east and $4\frac{1}{2}$ blocks north
- C. 5 blocks east and 6 blocks north
- D. $8\frac{1}{2}$ blocks east and $4\frac{1}{2}$ blocks north
- E. 9 blocks east and $7\frac{1}{2}$ blocks north

GO ON TO THE NEXT PAGE.

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22. The braking distance, y feet, for Damon's car to come to a complete stop is modeled by $y = \frac{3(x^2 + 10x)}{40}$, where x is the speed of the car in miles per hour. According to this model, which of the following is the maximum speed, in miles per hour, Damon can be driving so that the braking distance is less than or equal to 150 feet?

DO YOUR FIGURING HERE.

- F. 10
- G. 30
- H. 40
- J. 50
- K. 60

23. If $f(x) = x^2 + x + 5$ and $g(x) = \sqrt{x}$, then what is the value of $\frac{g(4)}{f(1)}$?

- A. $\frac{2}{7}$
- B. $\frac{25}{7}$
- C. $\frac{2}{25}$
- D. 2
- E. 4

24. At a school picnic, 1 junior and 1 senior will be selected to lead the activities. If there are 125 juniors and 100 seniors at the picnic, how many different 2-person combinations of 1 junior and 1 senior are possible?

- F. 25
- G. 100
- H. 125
- J. 225
- K. 12,500

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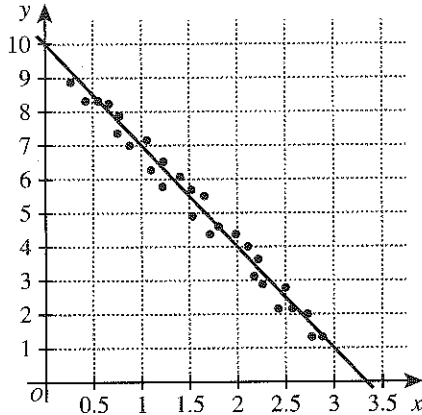
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25. The scatterplot in the standard (x,y) coordinate plane below contains data points showing a strong linear correlation between the variables x and y . Mia drew the line shown to model the data. One of the following equations represents Mia's line. Which one?

DO YOUR FIGURING HERE.



- A. $y = -3x + 8$
 B. $y = -3x + 10$
 C. $y = -2x + 10$
 D. $y = 2x + 10$
 E. $y = 2x + 8$
26. The temperature, t , in degrees Fahrenheit, in a certain town on a certain spring day satisfies the inequality $|t - 24| \leq 30$. Which of the following temperatures, in degrees Fahrenheit, is NOT in this range?
- F. -10
 G. -6
 H. -5
 J. 0
 K. 54
27. If 5 times a number n is subtracted from 15, the result is negative. Which of the following gives the possible value(s) for n ?
- A. 0 only
 B. 3 only
 C. 10 only
 D. All $n > 3$
 E. All $n < 3$
28. For all $x > 21$, $\frac{(x^2 + 8x + 7)(x - 3)}{(x^2 + 4x - 21)(x + 1)} = ?$
- F. 1
 G. $\frac{9}{7}$
 H. $\frac{x - 3}{x + 3}$
 J. $\frac{2(x - 3)}{x + 1}$
 K. $-\frac{4(x - 3)}{x + 1}$

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Taking Additional Practice Tests

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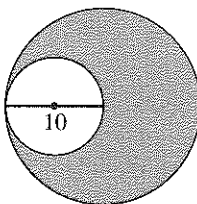


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DO YOUR FIGURING HERE.

29. The median of a set of data containing 9 items was found. Four data items were added to the set. Two of these items were greater than the original median, and the other 2 items were less than the original median. Which of the following statements *must* be true about the median of the new data set?
- A. It is the average of the 2 new lower values.
 - B. It is the same as the original median.
 - C. It is the average of the 2 new higher values.
 - D. It is greater than the original median.
 - E. It is less than the original median.

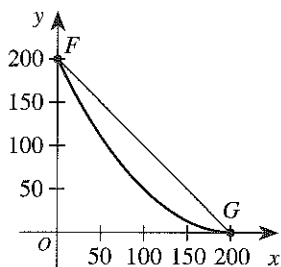
30. The figure below shows 2 tangent circles such that the 10-centimeter diameter of the smaller circle is equal to the radius of the larger circle. What is the area, in square centimeters, of the shaded region?



- F. 10
 - G. 75
 - H. 5π
 - J. 10π
 - K. 75π
31. The sign of a is positive. The sign of b is negative. If it can be determined, what is the sign of the mean of a and b ?
- A. Positive
 - B. Negative
 - C. Both positive and negative
 - D. Neither positive nor negative
 - E. Cannot be determined from the given information

Use the following information to answer questions 32–34.

The curve $y = 0.005x^2 - 2x + 200$ for $0 \leq x \leq 200$ and the line segment from $F(0,200)$ to $G(200,0)$ are shown in the standard (x,y) coordinate plane below.



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32. What is the y -coordinate for the point on the curve with x -coordinate 20?

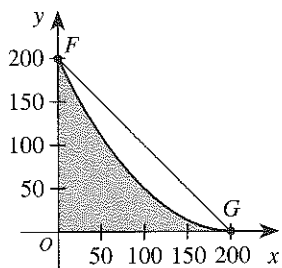
F. 160
G. 162
H. 164
J. 166
K. 168

DO YOUR FIGURING HERE.

33. The length of this curve is longer than \overline{FG} . About how many coordinate units long is \overline{FG} ?

A. 20
B. 141
C. 200
D. 283
E. 400

34. Tran wants to approximate the area underneath the curve $y = 0.005x^2 - 2x + 200$ for $0 \leq x \leq 200$, shown shaded in the graph below.



He finds an initial estimate, A , for the shaded area by using \overline{FG} and computing

$$A = \frac{1}{2}(200 \text{ units})(200 \text{ units}) = 20,000 \text{ square units.}$$

The area of the shaded region is:

- F. less than 20,000 square units, because the curve lies under \overline{FG} .
G. less than 20,000 square units, because the curve lies over \overline{FG} .
H. equal to 20,000 square units.
J. greater than 20,000 square units, because the curve lies under \overline{FG} .
K. greater than 20,000 square units, because the curve lies over \overline{FG} .

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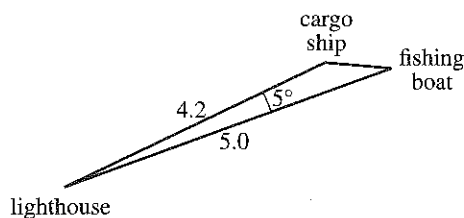
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35. A cargo ship is 4.2 miles from a lighthouse, and a fishing boat is 5.0 miles from the lighthouse, as shown below. The angle between the straight lines from the lighthouse to the 2 vessels is 5° . The approximate distance, in miles, from the cargo ship to the fishing boat is given by which of the following expressions?

(Note: The law of cosines states that for any triangle with vertices A , B , and C and the sides opposite those vertices with lengths a , b , and c , respectively, $c^2 = a^2 + b^2 - 2ab \cos C$.)



DO YOUR FIGURING HERE.

- A. $\sqrt{(5.0)^2 - (4.2)^2}$
 B. $\sqrt{(4.2)^2 + (5.0)^2 - 2 \cdot 4.2 \cdot 5.0 \cos 5^\circ}$
 C. $\sqrt{(4.2)^2 + (5.0)^2 + 2 \cdot 4.2 \cdot 5.0 \cos 5^\circ}$
 D. $\sqrt{(4.2)^2 + (5.0)^2 - 2 \cdot 4.2 \cdot 5.0 \cos 85^\circ}$
 E. $\sqrt{(4.2)^2 + (5.0)^2 + 2 \cdot 4.2 \cdot 5.0 \cos 85^\circ}$
36. Which of the following equations expresses c in terms of a for all real numbers a , b , and c such that $a^3 = b$ and $b^2 = c$?
- F. $c = a^6$
 G. $c = a^5$
 H. $c = 2a^3$
 J. $c = \frac{1}{2}a$
 K. $c = a$
37. After visiting Florida State University during spring break, Francisco rents a car for 2 days to travel around Florida. He has \$255 to spend on car rental for the 2 days. Sea Horse Car Rental charges \$50 per day and \$0.25 per mile. Ocean Blue Car Rental charges \$60 per day and \$0.20 per mile. Which company, if either, allows him to travel more miles for the 2 days, and how many miles more?
- (Note: Taxes are already included in the rental charges.)
- A. Sea Horse, 20
 B. Ocean Blue, 55
 C. Ocean Blue, 100
 D. Sea Horse, 135
 E. Francisco would get the same maximum number of miles from each company.

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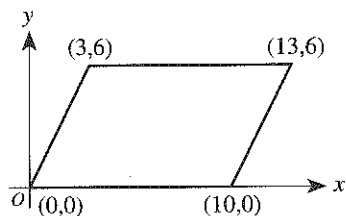


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38. In the standard (x,y) coordinate plane below, the points $(0,0)$, $(10,0)$, $(13,6)$, and $(3,6)$ are the vertices of a parallelogram. What is the area, in square coordinate units, of the parallelogram?

DO YOUR FIGURING HERE.

- F. 30
G. 60
H. $30\sqrt{3}$
J. $30\sqrt{5}$
K. $60\sqrt{5}$



39. For every pair of natural numbers n and m , to which of the following sets must $n + m$ belong?
- I. The natural numbers
 - II. The integers
 - III. The rational numbers
 - IV. The real numbers
 - V. The complex numbers
- A. I, II, and III only
B. II, III, and IV only
C. III, IV, and V only
D. II, III, IV, and V only
E. I, II, III, IV, and V
40. A certain perfect square has exactly 4 digits (that is, it is an integer between 1,000 and 9,999). The positive square root of the perfect square must have how many digits?
- F. 1
G. 2
H. 3
J. 4
K. Cannot be determined from the given information
41. A certain hotel has 80 rooms. Based on many previous years' occupancy rates, the owners of the hotel constructed the table below showing the daily occupancy rates and their probabilities of occurring for the coming summer season. Based on the probability distribution in the table, to the nearest whole number, what is the expected number of rooms that will be occupied on any day during the coming summer season?

Occupancy rate	Probability
0.60	0.20
0.70	0.40
0.80	0.30
0.90	0.10

- A. 20
B. 25
C. 58
D. 60
E. 75

GO ON TO THE NEXT PAGE.

2



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42. What is the matrix product $\begin{bmatrix} a \\ 2a \\ 3a \end{bmatrix} [1 \ 0 \ -1]$?

DO YOUR FIGURING HERE.

F. $\begin{bmatrix} a & 0 & -a \\ 2a & 0 & -2a \\ 3a & 0 & -3a \end{bmatrix}$

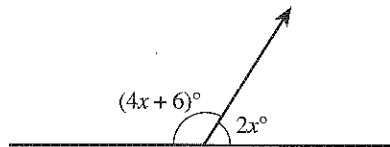
G. $\begin{bmatrix} a & 2a & 3a \\ 0 & 0 & 0 \\ -a & -2a & -3a \end{bmatrix}$

H. $[2a \ 0 \ -2a]$

J. $[6a \ 0 \ -6a]$

K. $[0]$

43. What is the degree measure of the smaller of the 2 angles formed by the line and the ray shown in the figure below?



- A. 14°
- B. 28°
- C. 29°
- D. 58°
- E. Cannot be determined from the given information

44. Let a equal $2b + 3c - 5$. What happens to the value of a if the value of b decreases by 1 and the value of c increases by 2 ?

- F. It increases by 4.
- G. It increases by 2.
- H. It increases by 1.
- J. It is unchanged.
- K. It decreases by 2.

45. Shima will mix 1 fluid ounce of fertilizer in water for every 40 square feet of soil. At this rate, which of the following expressions gives the number of gallons of fertilizer that Shima will mix in water for 0.5 acres of soil?

(Note: 1 acre = 43,560 square feet;
1 gallon = 128 fluid ounces)

- A. $\frac{0.5(40)(128)}{43,560}$
- B. $\frac{40(128)}{0.5(43,560)}$
- C. $\frac{0.5(43,560)}{40(128)}$
- D. $\frac{43,560}{0.5(40)(128)}$
- E. $\frac{0.5(43,560)(40)}{128}$

GO ON TO THE NEXT PAGE.

2



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DO YOUR FIGURING HERE.

46. A restaurant has 10 booths that will seat up to 4 people each. If 20 people are seated in booths, and NO booths are empty, what is the greatest possible number of booths that could be filled with 4 people?

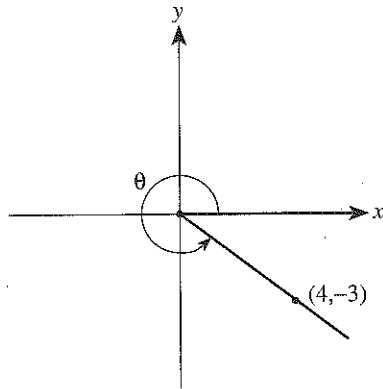
- F. 0
- G. 1
- H. 2
- J. 3
- K. 5

47. Let A and B be independent events. Denote $P(A)$ as the probability that Event A will occur, and denote $P(A \cap B)$ as the probability that Events A and B will both occur. Which of the following equations *must* be true?

- A. $P(A) = P(B)$
- B. $P(A) = 1 - P(B)$
- C. $P(A \cap B) = P(A) + P(B)$
- D. $P(A \cap B) = P(A) \cdot P(B)$
- E. $P(A \cap B) = P(A) + P(B) - (P(A) \cdot P(B))$

48. In the standard (x,y) coordinate plane below, an angle is shown whose vertex is the origin. One side of this angle with measure θ passes through $(4,-3)$, and the other side includes the positive x -axis. What is the cosine of θ ?

- F. $-\frac{4}{3}$
- G. $-\frac{3}{4}$
- H. $-\frac{3}{5}$
- J. $\frac{4}{5}$
- K. $\frac{5}{4}$



49. Which of the following expressions, if any, are equal for all real numbers x ?

- I. $\sqrt{(-x)^2}$
 - II. $|-x|$
 - III. $-|x|$
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II, and III
 - E. None of the expressions are equivalent.

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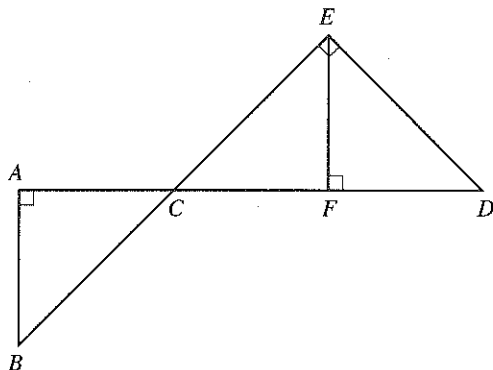
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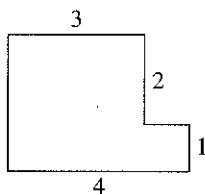
50. In the figure below, A , C , F , and D are collinear; B , C , and E are collinear; and the angles at A , E , and F are right angles, as marked. Which of the following statements is NOT justifiable from the given information?

DO YOUR FIGURING HERE.



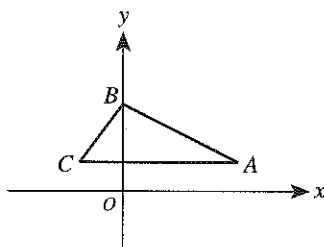
- F. \overleftrightarrow{AB} is parallel to \overleftrightarrow{EF} .
 G. \overline{DE} is perpendicular to \overline{BE} .
 H. $\angle ACB$ is congruent to $\angle FCE$.
 J. $\triangle BAC$ is similar to $\triangle EFC$.
 K. \overline{CE} is congruent to \overline{ED} .
51. In the figure below, all line segments are either horizontal or vertical and the dimensions given are in inches. What is the perimeter, in inches, of the figure?

- A. 10
 B. 12
 C. 13
 D. 14
 E. 16



52. Triangle $\triangle ABC$ has vertices $A(8,2)$, $B(0,6)$, and $C(-3,2)$. Point C can be moved along a certain line, with points A and B remaining stationary, and the area of $\triangle ABC$ will not change. What is the slope of that line?

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



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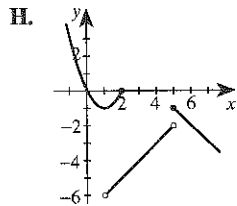
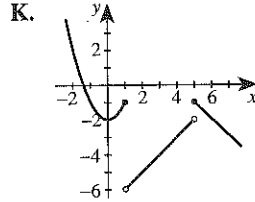
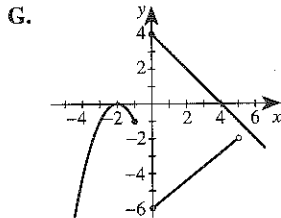
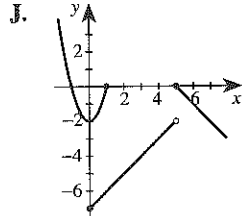
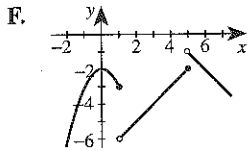
DO YOUR FIGURING HERE.

53. On his first day as a telemarketer, Marshall made 24 calls. His goal was to make 5 more calls on each successive day than he had made the day before. If Marshall met, but did not exceed, his goal, how many calls had he made in all after spending exactly 20 days making calls as a telemarketer?

- A. 670
- B. 690
- C. 974
- D. 1,430
- E. 1,530

54. Which of the following is the graph of the function $f(x)$ defined below?

$$f(x) = \begin{cases} x^2 - 2 & \text{for } x \leq 1 \\ x - 7 & \text{for } 1 < x < 5 \\ 4 - x & \text{for } x \geq 5 \end{cases}$$



55. Which of the following expressions gives the number of permutations of 15 objects taken 5 at a time?

- A. $15(5)$
- B. $(15 - 5)!$
- C. $\frac{15!}{5!}$
- D. $\frac{15!}{(15 - 5)!}$
- E. $\frac{15!}{(5!)(15 - 5)!}$

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2



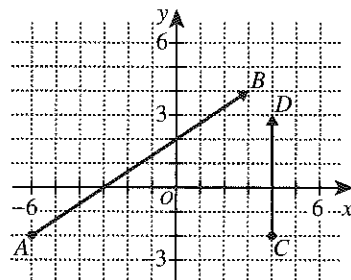
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56. For all $x > 0$, which of the following expressions is equivalent to $\frac{i}{\sqrt{x}-i}$, where $i = \sqrt{-1}$?

DO YOUR FIGURING HERE.

- F. i
- G. $\frac{\sqrt{x}}{x}$
- H. $\frac{\sqrt{x}-1}{x+1}$
- J. $\frac{i\sqrt{x}+1}{x-1}$
- K. $\frac{i\sqrt{x}-1}{x+1}$

57. Vectors \vec{AB} and \vec{CD} are shown in the standard (x,y) coordinate plane below. One of the following is the unit vector notation of the vector $\vec{AB} + \vec{CD}$. Which one?



- A. $-6\mathbf{i} + 3\mathbf{j}$
 - B. $3\mathbf{i} - 1\mathbf{j}$
 - C. $3\mathbf{i} + 9\mathbf{j}$
 - D. $9\mathbf{i} + 1\mathbf{j}$
 - E. $9\mathbf{i} + 11\mathbf{j}$
58. A simple pendulum consists of a small mass suspended from a string that is fixed at its upper end and has negligible mass. The length of time, t seconds, for a complete swing of a simple pendulum can be modeled by the equation $t = 2\pi\sqrt{\frac{L}{32}}$, where L is the length, in feet, of the string. If the time required for a complete swing of Pendulum 1 is triple the time required for a complete swing of Pendulum 2, the length of Pendulum 1's string is how many times the length of Pendulum 2's string?
- F. $\frac{1}{3}$
 - G. 3
 - H. 6
 - J. 9
 - K. 27

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2**2**

59. If $\log_a x = s$ and $\log_a y = t$, then $\log_a (xy)^2 = ?$

- A. $2(s + t)$
- B. $s + t$
- C. $4st$
- D. $2st$
- E. st

60. Jennifer's best long jump distance increased by 10% from 1990 to 1991 and by 20% from 1991 to 1992. By what percent did her best long jump distance increase from 1990 to 1992?

- F. 32%
- G. 30%
- H. 20%
- J. 15%
- K. 2%

DO YOUR FIGURING HERE.**END OF TEST 2****STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.****DO NOT RETURN TO THE PREVIOUS TEST.**