



## 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.

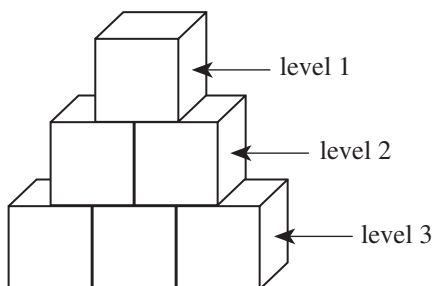
You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

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. Carmen is playing with blocks. She arranges stacks of blocks so that each successive level of blocks has 1 fewer block than the level below it and the top level has 1 block. Such a stack with 3 levels is shown below. Carmen wants to make such a stack with 12 levels. How many blocks would she use to build this stack?



- A. 66  
B. 78  
C. 132  
D. 144  
E. 156
2. To keep up with rising expenses, a motel manager needs to raise the \$40.00 room rate by 22%. What will be the new rate?  
F. \$40.22  
G. \$42.20  
H. \$48.00  
J. \$48.80  
K. \$62.00
3. As a salesperson, your commission is directly proportional to the dollar amount of sales you make. If your sales are \$800, your commission is \$112. How much commission would you earn if you had \$1,400 in sales?  
A. \$210  
B. \$196  
C. \$175  
D. \$128  
E. \$ 64

4. If  $7 + 3x = 22$ , then  $2x = ?$

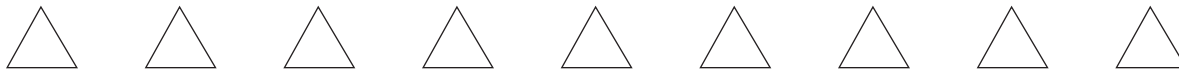
- F. 5  
G. 10  
H. 12  
J. 14  
K.  $\frac{58}{3}$

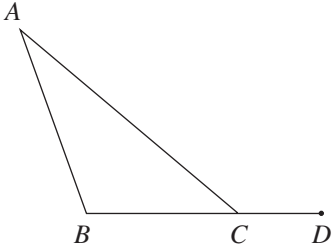
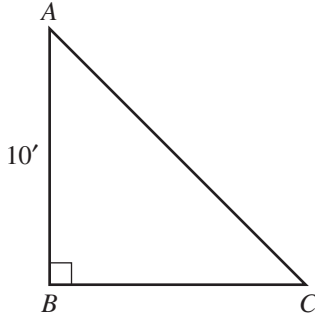
5. The total cost of renting a car is \$30.00 for each day the car is rented plus  $28\frac{1}{2}\text{¢}$  for each mile the car is driven. What is the total cost of renting the car for 5 days and driving 350 miles?

(Note: No sales tax is involved.)

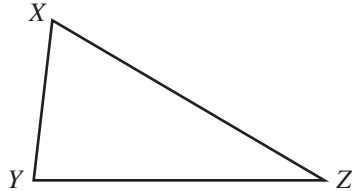
- A. \$ 104.75  
B. \$ 159.98  
C. \$ 249.75  
D. \$ 300.00  
E. \$1,147.50

6. In any parallelogram  $ABCD$ , it is always true that the measures of  $\angle ABC$  and  $\angle BCD$ :  
F. add up to  $180^\circ$ .  
G. add up to  $90^\circ$ .  
H. are each greater than  $90^\circ$ .  
J. are each  $90^\circ$ .  
K. are each less than  $90^\circ$ .



7. What is the least common denominator for adding the fractions  $\frac{4}{15}$ ,  $\frac{1}{12}$ , and  $\frac{3}{8}$ ?
- A. 40  
B. 120  
C. 180  
D. 480  
E. 1,440
8. The product  $(2x^4y)(3x^5y^8)$  is equivalent to:
- F.  $5x^9y^9$   
G.  $6x^9y^8$   
H.  $6x^9y^9$   
J.  $5x^{20}y^8$   
K.  $6x^{20}y^8$
9. It costs  $a$  dollars for an adult ticket to a reggae concert and  $s$  dollars for a student ticket. The difference between the cost of 12 adult tickets and 18 student tickets is \$36. Which of the following equations represents this relationship between  $a$  and  $s$ ?
- A.  $\frac{12a}{18s} = 36$   
B.  $216as = 36$   
C.  $|12a - 18s| = 36$   
D.  $|12a + 18s| = 36$   
E.  $|18a + 12s| = 36$
10. If  $x > 1$ , then which of the following has the LEAST value?
- F.  $\sqrt{x}$   
G.  $\sqrt{2x}$   
H.  $\sqrt{x \cdot x}$   
J.  $x\sqrt{x}$   
K.  $x \cdot x$
11. Charles defined a new operation,  $\blacklozenge$ , on pairs of ordered pairs of integers as follows:  $(a,b) \blacklozenge (c,d) = \frac{ac + bd}{ab - cd}$ . What is the value of  $(2,1) \blacklozenge (3,4)$ ?
- A. -2  
B. -1  
C. 2  
D. 5  
E. 10
12. In the figure below,  $\angle BAC$  measures  $30^\circ$ ,  $\angle ABC$  measures  $110^\circ$ , and points  $B$ ,  $C$ , and  $D$  are collinear. What is the measure of  $\angle ACD$ ?
- 
- F.  $150^\circ$   
G.  $140^\circ$   
H.  $130^\circ$   
J.  $120^\circ$   
K.  $110^\circ$
13. In the isosceles right triangle below,  $AB = 10$  feet. What is the length, in feet, of  $\overline{AC}$ ?
- 
- A. 5  
B. 10  
C. 20  
D.  $\sqrt{20}$   
E.  $10\sqrt{2}$
14. In a bag of 400 jelly beans, 25% of the jelly beans are red in color. If you randomly pick a jelly bean from the bag, what is the probability that the jelly bean picked is NOT one of the red jelly beans?
- F.  $\frac{1}{2}$   
G.  $\frac{1}{4}$   
H.  $\frac{3}{4}$   
J.  $\frac{1}{16}$   
K.  $\frac{15}{16}$



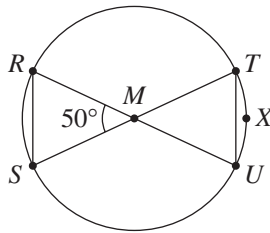
15. What polynomial must be added to  $x^2 - 2x + 6$  so that the sum is  $3x^2 + 7x$ ?
- A.  $4x^2 + 5x + 6$   
 B.  $3x^2 + 9x + 6$   
 C.  $3x^2 + 9x - 6$   
 D.  $2x^2 + 9x - 6$   
 E.  $2x^2 - 5x + 6$
16. What is the slope of any line parallel to the line  $8x + 9y = 3$  in the standard  $(x,y)$  coordinate plane?
- F.  $-8$   
 G.  $-\frac{8}{9}$   
 H.  $\frac{8}{3}$   
 J.  $3$   
 K.  $8$
17. In the standard  $(x,y)$  coordinate plane, a line segment has its endpoints at  $(3,6)$  and  $(9,4)$ . What are the coordinates of the midpoint of the line segment?
- A.  $(3,-1)$   
 B.  $(3, 1)$   
 C.  $(6, 2)$   
 D.  $(6, 5)$   
 E.  $(12,10)$
18. When  $y = x^2$ , which of the following expressions is equivalent to  $-y$ ?
- F.  $(-x)^2$   
 G.  $-x^2$   
 H.  $-x$   
 J.  $x^{-2}$   
 K.  $x$
19. For the function  $h(x) = 4x^2 - 5x$ , what is the value of  $h(-3)$ ?
- A.  $-93$   
 B.  $-9$   
 C.  $21$   
 D.  $51$   
 E.  $159$
20. For all triangles  $\triangle XYZ$  where side  $\overline{XZ}$  is longer than side  $\overline{YZ}$ , such as the triangle shown below, which of the following statements is true?
- 
- F. The measure of  $\angle X$  is always less than the measure of  $\angle Y$ .  
 G. The measure of  $\angle X$  is always equal to the measure of  $\angle Y$ .  
 H. The measure of  $\angle X$  is always greater than the measure of  $\angle Y$ .  
 J. The measure of  $\angle X$  is sometimes less than the measure of  $\angle Y$  and sometimes equal to the measure of  $\angle Y$ .  
 K. The measure of  $\angle X$  is sometimes greater than the measure of  $\angle Y$  and sometimes equal to the measure of  $\angle Y$ .
21.  $|7(-3) + 2(4)| = ?$
- A.  $-28$   
 B.  $-13$   
 C.  $13$   
 D.  $28$   
 E.  $29$
22. If  $x > |y|$ , which of the following is the solution statement for  $x$  when  $y = -4$ ?
- F.  $x$  is any real number.  
 G.  $x > 4$   
 H.  $x < 4$   
 J.  $-4 < x < 4$   
 K.  $x > 4$  or  $x < -4$
23. The perimeter of a parallelogram is 72 inches, and 1 side measures 12 inches. What are the lengths, in inches, of the other 3 sides?
- A. 12, 12, 36  
 B. 12, 18, 18  
 C. 12, 24, 24  
 D. 12, 30, 30  
 E. Cannot be determined from the given information
24. The lengths of the corresponding sides of 2 similar right triangles are in the ratio of 2:5. If the hypotenuse of the smaller triangle is 5 inches long, how many inches long is the hypotenuse of the larger triangle?
- F. 2  
 G. 2.5  
 H. 7  
 J. 10  
 K. 12.5



25. The sides of a square are 3 cm long. One vertex of the square is at (3,0) on a square coordinate grid marked in centimeter units. Which of the following points could also be a vertex of the square?

A. ( 6, 0)  
 B.  $(4\frac{1}{2}, 1\frac{1}{2})$   
 C. ( 1, 2)  
 D. ( 0, -2)  
 E. (-3, 0)

26. In the circle shown below,  $M$  is the center and lies on  $\overline{RU}$  and  $\overline{ST}$ . Which of the following statements is NOT true?



- F.  $\angle TUM$  measures  $65^\circ$   
 G.  $\overline{TU}$  is parallel to  $\overline{RS}$   
 H.  $\widehat{TXU}$  measures  $50^\circ$   
 J.  $\overline{RM} \cong \overline{TM}$   
 K.  $\overline{RS} \cong \overline{SM}$
27. John Jones has decided to go into the business of producing and selling boats. In order to begin this venture, he must invest \$10 million in a boat production plant. The cost to produce each boat will be \$7,000, and the selling price will be \$20,000. Accounting for the cost of the production plant, which of the following expressions represents the profit, in dollars, that John will realize when  $x$  boats are produced and sold?

A.  $13,000x - 10,000,000$   
 B.  $27,000x - 10,000,000$   
 C.  $9,973,000x$   
 D.  $20,000x$   
 E.  $13,000x$

28. If  $2x^2 + 6x = 36$ , what are the possible values of  $x$ ?

F. -12 and 3  
 G. -6 and 3  
 H. -3 and 6  
 J. -3 and 12  
 K. 12 and 15

29. As a class experiment, a cart was rolled at a constant rate along a straight line. Shawn recorded in the chart below the cart's distance ( $x$ ), in feet, from a reference point at the start of the experiment and for each of 5 times ( $t$ ), in seconds.

$t$	0	1	2	3	4	5
$x$	10	14	18	22	26	30

Which of the following equations represents this data?

A.  $x = t + 10$   
 B.  $x = 4t + 6$   
 C.  $x = 4t + 10$   
 D.  $x = 10t + 4$   
 E.  $x = 14t$

30. To increase the mean of 4 numbers by 2, by how much would the sum of the 4 numbers have to increase?

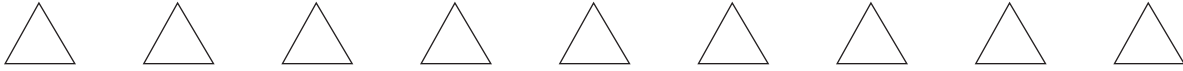
F. 2  
 G. 4  
 H. 6  
 J. 8  
 K. 16

31. Meg pounded a stake into the ground. When she attached a leash to both the stake and her dog's collar, the dog could reach 9 feet from the stake in any direction. Using 3.14 for  $\pi$ , what is the approximate area of the lawn, in square feet, the dog could reach from the stake?

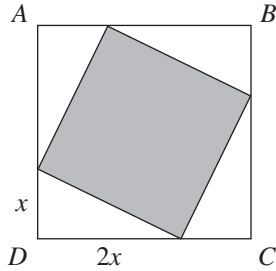
A. 28  
 B. 57  
 C. 113  
 D. 254  
 E. 283

32. Television screen sizes are the diagonal length of the rectangular screen. Hector recently changed from watching a television with a 13-inch screen to a television with a similar 19-inch screen. If a boxcar appeared 8 inches long on the 13-inch screen, how long, to the nearest inch, will it appear on the 19-inch screen?

F. 10  
 G. 12  
 H. 14  
 J. 16  
 K. 18

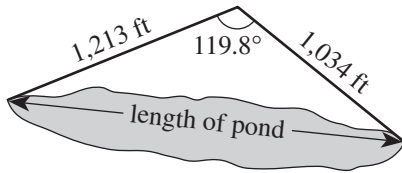


33. In the figure below,  $ABCD$  is a square. Points are chosen on each pair of adjacent sides of  $ABCD$  to form 4 congruent right triangles, as shown below. Each of these has one leg that is twice as long as the other leg. What fraction of the area of square  $ABCD$  is shaded?



- A.  $\frac{1}{9}$
- B.  $\frac{2}{9}$
- C.  $\frac{4}{9}$
- D.  $\frac{5}{9}$
- E.  $\frac{8}{9}$

34. A surveyor took and recorded the measurements shown in the figure below. If the surveyor wants to use these 3 measurements to calculate the length of the pond, which of the following would be the most directly applicable?



- F. The Pythagorean theorem
- G. A formula for the area of a triangle
- H. The ratios for the side lengths of  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles
- J. The ratios for the side lengths of  $45^\circ$ - $45^\circ$ - $90^\circ$  triangles
- K. The law of cosines: For any  $\triangle ABC$ , where  $a$  is the length of the side opposite  $\angle A$ ,  $b$  is the length of the side opposite  $\angle B$ , and  $c$  is the length of the side opposite  $\angle C$ ,  $a^2 = b^2 + c^2 - 2bc \cos(\angle A)$

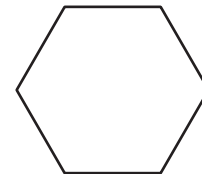
35. Which of the following is the graph of the equation  $2x + y = 4$  in the standard  $(x,y)$  coordinate plane?

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

36. Which of the following figures in a plane separates it into half-planes?

- F. A line
- G. A ray
- H. An angle
- J. A point
- K. A line segment

37. What is the maximum number of distinct diagonals that can be drawn in the hexagon shown below?

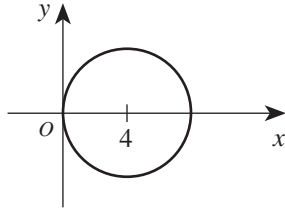


- A. 4
- B. 5
- C. 6
- D. 9
- E. 12



38. In the standard  $(x,y)$  coordinate plane, the center of the circle shown below lies on the  $x$ -axis at  $x = 4$ . If the circle is tangent to the  $y$ -axis, which of the following is an equation of the circle?

- F.  $(x + 4)^2 + y^2 = 4$   
 G.  $(x - 4)^2 + y^2 = 16$   
 H.  $(x - 4)^2 - y^2 = 16$   
 J.  $(x - 4)^2 + y^2 = 4$   
 K.  $x^2 + (y - 4)^2 = 16$

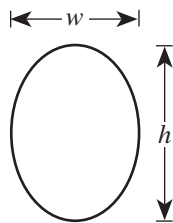


39. In what order should  $\frac{5}{3}$ ,  $\frac{7}{4}$ ,  $\frac{6}{5}$ , and  $\frac{9}{8}$  be listed to be arranged by increasing size?

- A.  $\frac{9}{8} < \frac{6}{5} < \frac{5}{3} < \frac{7}{4}$   
 B.  $\frac{9}{8} < \frac{6}{5} < \frac{7}{4} < \frac{5}{3}$   
 C.  $\frac{7}{4} < \frac{5}{3} < \frac{9}{8} < \frac{6}{5}$   
 D.  $\frac{6}{5} < \frac{9}{8} < \frac{5}{3} < \frac{7}{4}$   
 E.  $\frac{5}{3} < \frac{6}{5} < \frac{7}{4} < \frac{9}{8}$

40. Mai is putting gold foil around the outside of an elliptical picture frame. The perimeter of an ellipse is given by the formula  $p = \frac{\pi}{2} \sqrt{2(h^2 + w^2)}$ , where  $h$  is the height and  $w$  is the width, as shown in the diagram below. If an elliptical frame has an outside height equal to 4 inches and an outside width equal to 3 inches, what is its outside perimeter, in inches?

- F.  $\frac{5}{2} \pi \sqrt{2}$   
 G.  $\frac{7}{2} \pi \sqrt{2}$   
 H.  $5\pi \sqrt{2}$   
 J.  $\frac{\pi}{2} (4\sqrt{2} + 3)$   
 K.  $(4\pi + 3)\sqrt{2}$



41. If  $\frac{A}{30} + \frac{B}{105} = \frac{7A+2B}{x}$  and  $A$ ,  $B$ , and  $x$  are integers greater than 1, then what must  $x$  equal?

- A. 9  
 B. 135  
 C. 210  
 D. 630  
 E. 3,150

Use the following information to answer questions 42–44.

Kaylee is planning to purchase a car. She will need to borrow some of the money and has a chart, shown below, to use to approximate her monthly payment. The chart gives the approximate monthly payment per \$1,000 borrowed.

Monthly payment per \$1,000 borrowed for various annual rates and various numbers of payments			
Annual interest rate	Number of monthly payments		
	36	48	60
5%	\$29.97	\$23.03	\$18.87
8%	\$31.34	\$24.41	\$20.28
10%	\$32.27	\$25.36	\$21.24
12%	\$33.22	\$26.34	\$22.24

42. Kaylee found a used car she is thinking about purchasing. The list price is \$8,795. She calculates that she will need to borrow \$6,500. Approximately what would her monthly payment be if she borrowed the money for 36 months at an annual interest rate of 10%?

- F. \$164.84  
 G. \$171.21  
 H. \$209.76  
 J. \$234.72  
 K. \$283.81

43. A local dealership is having an end-of-the-model-year clearance sale and is offering 5% annual interest on new-car loans for 36, 48, or 60 months. The maximum amount Kaylee can budget for her monthly car payment is \$300. Of the following loan amounts, which one is the maximum Kaylee can borrow at 5% annual interest and stay within her budget?

- A. \$10,000  
 B. \$13,000  
 C. \$14,000  
 D. \$15,000  
 E. \$20,000

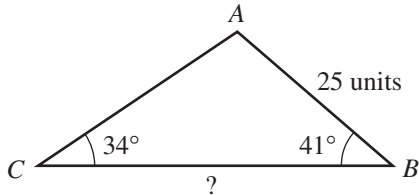
44. Another dealership is offering 5-year loans with a 9% annual interest rate. Kaylee uses her chart to estimate the payment per \$1,000 borrowed. Of the following, which is most likely the monthly payment per \$1,000 borrowed?

- F. \$20.52  
 G. \$20.76  
 H. \$20.85  
 J. \$21.00  
 K. \$21.74



45. In  $\triangle ABC$ , shown below, the measure of  $\angle B$  is  $41^\circ$ , the measure of  $\angle C$  is  $34^\circ$ , and  $\overline{AB}$  is 25 units long. Which of the following is an expression for the length, in units, of  $\overline{BC}$ ?

(Note: The law of sines states that, for any triangle, the ratios of the sines of the interior angles to the lengths of the sides opposite those angles are equal.)

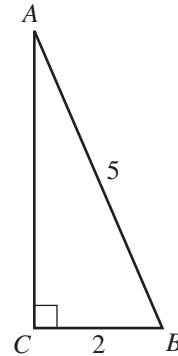


- A.  $\frac{25 \sin 105^\circ}{\sin 41^\circ}$   
 B.  $\frac{25 \sin 105^\circ}{\sin 34^\circ}$   
 C.  $\frac{25 \sin 75^\circ}{\sin 41^\circ}$   
 D.  $\frac{25 \sin 41^\circ}{\sin 105^\circ}$   
 E.  $\frac{25 \sin 34^\circ}{\sin 75^\circ}$
46. For  $i^2 = -1$ ,  $(4 + i)^2 = ?$   
 F. 15  
 G. 17  
 H.  $15 + 4i$   
 J.  $15 + 8i$   
 K.  $16 + 4i$
47. If  $r$  and  $s$  can be any integers such that  $s > 10$  and  $2r + s = 15$ , which of the following is the solution set for  $r$ ?  
 A.  $r \geq 3$   
 B.  $r \geq 0$   
 C.  $r \geq 2$   
 D.  $r \leq 0$   
 E.  $r \leq 2$
48. Which of the following expressions has a positive value for all  $x$  and  $y$  such that  $x > 0$  and  $y < 0$ ?  
 F.  $y - x$   
 G.  $x + y$   
 H.  $x^3y$   
 J.  $\frac{x^2}{y}$   
 K.  $\frac{x}{y^2}$

49. What is the value of  $\log_2 8$ ?

- A. 3  
 B. 4  
 C. 6  
 D. 10  
 E. 16

50. In the right triangle below, the measure of  $\angle C$  is  $90^\circ$ ,  $AB = 5$  units, and  $CB = 2$  units. What is  $\tan B$ ?

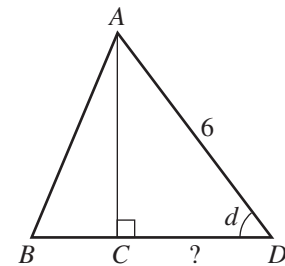


- F.  $\frac{\sqrt{21}}{2}$   
 G.  $\frac{3}{2}$   
 H.  $\frac{\sqrt{21}}{5}$   
 J.  $\frac{3}{5}$   
 K.  $\frac{2}{5}$

51. A flight instructor charges \$50 per lesson, plus an additional fee for the use of his plane. The charge for the use of the plane varies directly with the square root of the time the plane is used. If a lesson plus 16 minutes of plane usage costs \$90, what is the total amount charged for a lesson having 36 minutes of plane usage?

- A. \$185  
 B. \$150  
 C. \$135  
 D. \$110  
 E. \$ 60

52. In  $\triangle ABD$ , shown below,  $C$  is on  $\overline{BD}$ , the length of  $\overline{AD}$  is 6 inches, and  $\sin d = 0.8$ . How many inches long is  $\overline{CD}$ ?



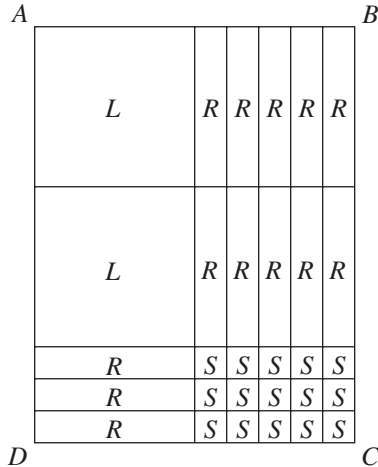
- F. 1.2  
 G. 1.8  
 H. 3.6  
 J. 4.8  
 K. Cannot be determined from the given information

53. For real numbers  $a$  and  $b$ , when is the equation  $|a + b| = |a - b|$  true?

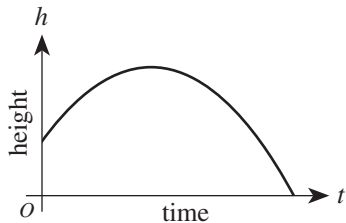
- A. Always  
 B. Only when  $a = b$   
 C. Only when  $a = 0$  and  $b = 0$   
 D. Only when  $a = 0$  or  $b = 0$   
 E. Never



54. As shown below, rectangle  $ABCD$  is divided into 2 large squares (labeled  $L$ ) each  $x$  inches on a side, 15 small squares (labeled  $S$ ) each  $y$  inches on a side, and 13 rectangles (labeled  $R$ ) each  $x$  inches by  $y$  inches. What is the total area, in square inches, of  $ABCD$ ?



- F.  $2x^2 + 13xy + 15y^2$   
 G.  $6x^2 + 16y^2$   
 H.  $2x^2 + 15y^2$   
 J.  $2x^2 + 8xy + 15y^2$   
 K.  $2x^2 + 13xy + 15y^2$
55. For some real number  $A$ , the graph of the line  $y = (A + 1)x + 8$  in the standard  $(x,y)$  coordinate plane passes through  $(2,6)$ . What is the slope of this line?  
 A.  $-4$   
 B.  $-3$   
 C.  $-1$   
 D.  $3$   
 E.  $7$
56. The graph of the equation  $h = -at^2 + bt + c$ , which describes how the height,  $h$ , of a hit baseball changes over time,  $t$ , is shown below.



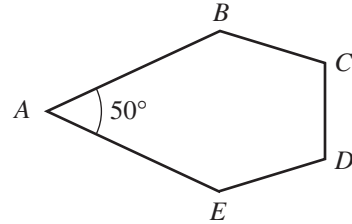
If you alter only this equation's  $c$  term, which gives the height at time  $t = 0$ , the alteration has an effect on which of the following?

- I. The  $h$ -intercept  
 II. The maximum value of  $h$   
 III. The  $t$ -intercept
- F. I only  
 G. II only  
 H. III only  
 J. I and III only  
 K. I, II, and III

57. When graphed in the standard  $(x,y)$  coordinate plane, the lines  $x = -3$  and  $y = x - 3$  intersect at what point?

- A.  $(0, 0)$   
 B.  $(0, -3)$   
 C.  $(-3, 0)$   
 D.  $(-3, -3)$   
 E.  $(-3, -6)$

58. In pentagon  $ABCDE$ , shown below,  $\angle A$  measures  $50^\circ$ . What is the total measure of the other 4 interior angles?



- F.  $130^\circ$   
 G.  $200^\circ$   
 H.  $310^\circ$   
 J.  $432^\circ$   
 K.  $490^\circ$
59. For all real numbers  $b$  and  $c$  such that the product of  $c$  and 3 is  $b$ , which of the following expressions represents the sum of  $c$  and 3 in terms of  $b$ ?
- A.  $b + 3$   
 B.  $3b + 3$   
 C.  $3(b + 3)$   
 D.  $\frac{b+3}{3}$   
 E.  $\frac{b}{3} + 3$
60. Which of the following expresses the number of meters a contestant must travel in a 3-lap race where the course is a circle of radius  $R$  meters?

- F.  $3R$   
 G.  $3\pi R$   
 H.  $3\pi R^2$   
 J.  $6R$   
 K.  $6\pi R$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.