

**MATHEMATICS TEST***60 Minutes—60 Questions*

**DIRECTIONS:** Solve each of the problems in the time allowed, then fill in the corresponding bubble on your answer sheet. Do not spend too much time on any one problem; skip the more difficult problems and go back to them later. You may

use a calculator on this test. For this test you should assume that figures are NOT necessarily drawn to scale, that all geometric figures lie in a plane, and that the word *line* is used to indicate a straight line.

1. Shannon walked  $1\frac{2}{3}$  miles on Wednesday and  $2\frac{3}{5}$  miles on Thursday. What was the total distance, in miles, Shannon walked during those 2 days?

A.  $3\frac{5}{8}$

B.  $3\frac{2}{5}$

C.  $4\frac{4}{15}$

D.  $4\frac{1}{3}$

E.  $5\frac{1}{3}$

2.  $4x^3 \times 3xy^2 \times 2xy^2$  is equivalent to:

F.  $9x^3y^4$

G.  $9x^5y^4$

H.  $24x^3y^4$

J.  $24x^5y^4$

K.  $24x^5y^6$

3. Mr. Wilk is a high school math teacher whose salary is \$33,660 for this school year, which has 180 days. In Mr. Wilk's school district, substitute teachers are paid \$85 per day. If Mr. Wilk takes a day off without pay and a substitute teacher is paid to teach his classes, how much less does the school district pay in salary by paying a substitute teacher instead of Mr. Wilk for that day?

A. \$57

B. \$85

C. \$102

D. \$114

E. \$187

4. A student has earned the following scores on four 100-point tests this marking period: 63, 72, 88, and 91. What score must the student earn on the fifth and final 100-point test of the marking period to earn an average test grade of 80 for the five tests?

F. 79

G. 86

H. 89

J. 94

K. The student cannot earn an average of 80.

**DO YOUR FIGURING HERE.**

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5. The oxygen saturation of a lake is found by dividing the amount of dissolved oxygen the lake water currently has per liter by the dissolved oxygen capacity per liter of the water, and then converting that number into a percent. If the lake currently has 6.4 milligrams of dissolved oxygen per liter of water and the dissolved oxygen capacity is 9.5 milligrams per liter, what is the oxygen saturation level of the lake, to the nearest percent?

A. 64%  
B. 67%  
C. 70%  
D. 89%  
E. 95%

6. A rectangular lot that measures 125 feet by 185 feet is completely fenced. What is the length, in feet, of the fence?

F. 310  
G. 435  
H. 620  
J. 740  
K. 1,240

7. The expression  $a[(b - c) + d]$  is equivalent to:

A.  $ab + ac + ad$   
B.  $ab - ac + d$   
C.  $ab - ac + ad$   
D.  $ab - c + d$   
E.  $a - c + d$

8. If  $6x - 3 = -5x + 7$ , then  $x = ?$

F.  $\frac{4}{11}$   
G.  $\frac{10}{11}$   
H.  $\frac{11}{10}$   
J.  $\frac{1}{2}$   
K. 10

9. What two numbers should be placed in the blanks below so that the difference between the consecutive numbers is the same?

13, \_\_, \_\_, 34

A. 19, 28  
B. 20, 27  
C. 21, 26  
D. 23, 24  
E. 24, 29

10. If  $x$  is a real number such that  $x^3 = 729$ , then  $x^2 + \sqrt{x} = ?$

F. 9  
G. 27  
H. 30  
J. 84  
K. 90

**DO YOUR FIGURING HERE.**

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11. The formula for the volume,  $V$ , of a sphere with radius  $r$  is  $V = \left(\frac{4}{3}\right)\pi r^3$ . If the radius of a baseball is  $1\frac{1}{3}$  inches, what is the volume to the nearest cubic inch?

A. 6  
 B. 8  
 C. 10  
 D. 14  
 E. 15

12. If a gumball is randomly chosen from a bag that contains exactly 6 yellow gumballs, 5 green gumballs, and 4 red gumballs, what is the probability that the gumball chosen is NOT green?

F.  $\frac{2}{3}$   
 G.  $\frac{1}{3}$   
 H.  $\frac{2}{5}$   
 J.  $\frac{3}{5}$   
 K.  $\frac{4}{15}$

13. The number of students participating in fall sports at a certain high school can be shown with the following matrix:

Tennis	Soccer	Cross-Country	Football
25	30	50	80

The athletic director estimates the ratio of the number of sports awards that will be earned to the number of students participating with the following matrix:

Tennis	0.2
Soccer	0.5
Cross-Country	0.3
Football	0.4

Given these matrices, what is the athletic director's estimate for the number of sports awards that will be earned for these fall sports?

A. 55  
 B. 60  
 C. 65  
 D. 67  
 E. 74

**DO YOUR FIGURING HERE.**

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Use the following information to answer questions 14–15.

**DO YOUR FIGURING HERE.**

The following chart shows the current enrollment in all social studies classes—Geography, US History, World Cultures, and Government—at Iron Mountain High School.

Course title	Section	Period	Enrollment
Geography	A	1	23
	B	2	24
US History	A	2	25
	B	3	29
	C	4	24
World Cultures	A	3	27
Government	A	4	26
	B	6	27

14. What is the average number of students enrolled per section in US History?
- F.** 25  
**G.** 26  
**H.** 27  
**J.** 29  
**K.** 34
15. The school wants to have all of the students enrolled in social studies classes read the same book at the same time so that the author of the book can speak to the students at an assembly. The school originally purchased two classroom sets of 30 books each, but now one set is missing 3 books and the other is missing 5. For which of the following class periods, if any, are there NOT enough books available for each student to have one book?
- A.** Period 2 only  
**B.** Period 3 only  
**C.** Period 4 only  
**D.** Period 3 and 4 only  
**E.** There are enough books for each class period
- 

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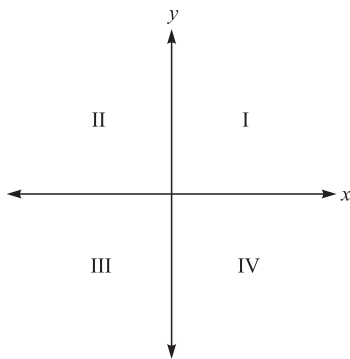


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16. What expression must the center cell of the table below contain so that the sums of each row and each column are equivalent?

$-4x$	$9x$	$2x$
$7x$		$-3x$
$4x$	$-5x$	$8x$

- F.  $5x$   
 G.  $3x$   
 H.  $0$   
 J.  $-x$   
 K.  $-4x$
17. Point  $A$  is to be graphed in a quadrant, not on an axis, of the standard  $(x, y)$  coordinate plane below. If the  $x$ -coordinate and the  $y$ -coordinate of point  $A$  are to have the same signs, then point  $A$  *must* be located in:



- A. Quadrant I only  
 B. Quadrant II only  
 C. Quadrant III only  
 D. Quadrant I or II only  
 E. Quadrant I or III only
18. Reggie knows how to make 5 different entrees, 4 different side dishes, and 6 different desserts. How many distinct complete meals, each consisting of an entrée, a side dish, and a dessert, can Reggie make?  
 F. 16  
 G. 26  
 H. 72  
 J. 120  
 K. 144
19. At a bottling plant, 10,000 liters of carbonated water are needed to produce 3,000 bottles of soda. How many liters of carbonated water are needed to produce 750 bottles of soda?  
 A. 225  
 B. 1,500  
 C. 2,500  
 D. 4,000  
 E. 5,000

DO YOUR FIGURING HERE.

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20. If a rectangle measures 20 meters by 48 meters, what is the length, in meters, of the diagonal of the rectangle?
- F. 52  
G. 68  
H. 72  
J. 112  
K. 2,704

DO YOUR FIGURING HERE.

21. For all positive integers  $a$ ,  $b$ , and  $c$ , which of the following expressions is equivalent to  $\frac{a}{c}$ ?

A.  $\frac{a \times b}{c \times b}$

B.  $\frac{a \times a}{c \times c}$

C.  $\frac{a \times c}{c \times a}$

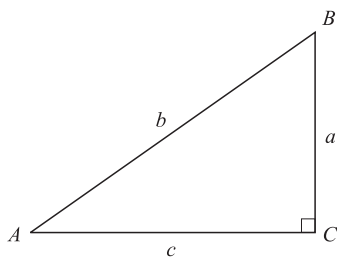
D.  $\frac{a - b}{c - b}$

E.  $\frac{a + b}{c + b}$

22. What is the slope-intercept form of  $6x - 2y - 4 = 0$ ?
- F.  $y = 6x - 2$   
G.  $y = 3x + 2$   
H.  $y = 3x - 2$   
J.  $y = -3x + 2$   
K.  $y = -6x - 4$

23. Which of the following is a solution to the equation  $x^2 + 25x = 0$ ?
- A. 50  
B. 25  
C. 5  
D. -5  
E. -25

24. For the right triangle  $\triangle ABC$  shown below, what is  $\tan B$ ?



F.  $\frac{a}{b}$

G.  $\frac{a}{c}$

H.  $\frac{b}{a}$

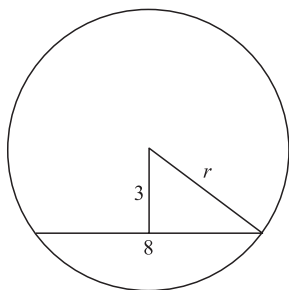
J.  $\frac{c}{a}$

K.  $\frac{c}{b}$

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25. A chord 8 inches long is 3 inches from the center of a circle, as shown below. What is the radius of the circle, to the nearest tenth of an inch?



- A. 4.0  
B. 4.3  
C. 5.0  
D. 6.9  
E. 8.5
26. The length  $L$ , in meters, of a spring is given by the equation  $L = \left(\frac{2}{3}\right)F + 0.05$ , where  $F$  is the applied force in newtons. Approximately what force, in newtons, must be applied for the spring's length to be 0.23 meters?  
F. 0.12  
G. 0.18  
H. 0.20  
J. 0.24  
K. 0.27
27. After a snowstorm, city workers removed an estimated 12,000 cubic meters of snow from the downtown area. If this snow were spread in an even layer over an empty lot with dimensions 62 meters by 85 meters, about how many meters deep would the layer of snow be?  
A. Less than 1  
B. Between 1 and 2  
C. Between 2 and 3  
D. Between 3 and 4  
E. More than 4

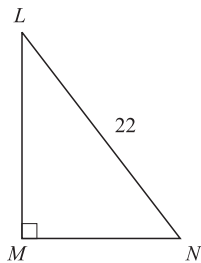
**DO YOUR FIGURING HERE.**

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28. The hypotenuse of the right triangle  $LMN$  shown below is 22 feet long. The cosine of angle  $L$  is  $\frac{3}{4}$ . How many feet long is the segment  $LM$ ?

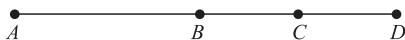


DO YOUR FIGURING HERE.

- F. 18.4
  - G. 16.5
  - H. 11.0
  - J. 6.7
  - K. 4.7
29. The table below shows the number of pounds of apples grown last year in 4 cities. (Each whole apple on the graph represents 1,000 pounds of apples.) According to the graph, what fraction of the apples grown in all 4 cities were grown in Appleton?

City	Apples grown
Golden Hills	
Red Falls	
Appleton	
Shady Acres	

- A.  $\frac{5}{24}$
  - B.  $\frac{1}{4}$
  - C.  $\frac{1}{6}$
  - D.  $\frac{5}{19}$
  - E.  $\frac{3}{16}$
30. Points  $B$  and  $C$  lie on segment  $AD$  as shown below. The length of segment  $AD$  is 25 units; the segment  $AC$  is 19 units long; and the segment  $BD$  is 14 units long. How many units long, if it can be determined, is the segment  $BC$ ?



- F. 5
- G. 6
- H. 8
- J. 11
- K. Cannot be determined from the given information.

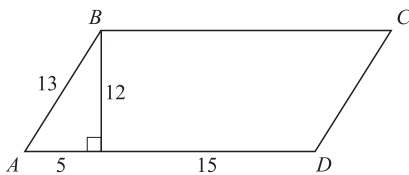
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31. What is the  $x$ -coordinate of the point in the standard  $(x, y)$  coordinate plane at which the two lines  $y = -2x + 7$  and  $y = 3x - 3$  intersect?
- A. 10  
B. 5  
C. 3  
D. 2  
E. 1
32. For all pairs of real numbers  $S$  and  $T$  where  $S = 4T - 7$ ,  $T = ?$
- F.  $\frac{S}{4} - 7$   
G.  $\frac{S}{4} + 7$   
H.  $4S + 7$   
J.  $\frac{S - 7}{4}$   
K.  $\frac{S + 7}{4}$
33. Parallelogram  $ABCD$ , with dimensions in inches, is shown in the diagram below. What is the area of the parallelogram, in square inches?



- A. 60  
B. 72  
C. 180  
D. 240  
E. 260
34. If  $b = a + 3$ , then  $(a - b)^4 = ?$
- F. 81  
G. 27  
H. -3  
J. -27  
K. -81

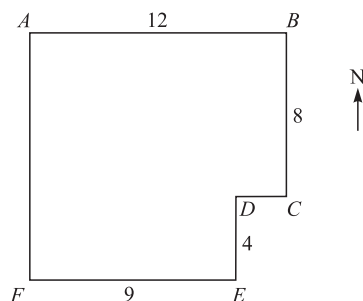
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35. A park has the shape and dimensions, in miles, given below. The park office is located halfway between point  $A$  and point  $D$ . Which of the following is the location of the park office from point  $A$ ? (Note: The park's borders run east–west or north–south.)



DO YOUR FIGURING HERE.

- A. 3 miles east and  $4\frac{1}{2}$  miles north
- B.  $4\frac{1}{2}$  miles east and 4 miles south
- C. 4 miles east and  $4\frac{1}{2}$  miles south
- D. 6 miles east and 4 miles south
- E. 6 miles east and  $4\frac{1}{3}$  miles south
36. The larger of two numbers exceeds three times the smaller number by 4. The sum of twice the larger number and 4 times the smaller number is 58. If  $x$  is the smaller number, which equation below determines the correct value of  $x$ ?
- F.  $3(2x + 4) + 4x = 58$
- G.  $3(2x - 4) + 3x = 58$
- H.  $2(3x + 4) + 2x = 58$
- J.  $2(3x + 4) + 4x = 58$
- K.  $2(2x - 4) + 4x = 58$
37. Members of the fire department lean a 26-foot ladder against a building. The side of the building is perpendicular to the level ground so that the base of the ladder is 10 feet away from the base of the building. To the nearest foot, how far up the building does the ladder reach?
- A. 12
- B. 15
- C. 20
- D. 22
- E. 24

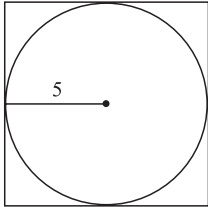
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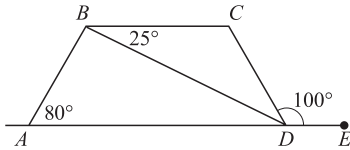


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38. A square is circumscribed about a circle of a 5-foot radius, as shown below. What is the area of the square, in square feet?



- F. 144  
 G. 100  
 H.  $25\pi$   
 J. 50  
 K. 25
39. The ratio of the side lengths for a triangle is exactly 7:11:13. In a second triangle similar to the first, the shortest side is 9 inches long. To the nearest tenth of an inch, what is the length of the longest side of the second triangle?
- A. 14.1  
 B. 15  
 C. 16.7  
 D. 17.3  
 E. Cannot be determined from the given information.
40. In the figure below,  $ABCD$  is a trapezoid.  $E$  lies on line  $AD$ , and angle measures are as marked. What is the measure of angle  $CDB$ ?



- F.  $25^\circ$   
 G.  $30^\circ$   
 H.  $55^\circ$   
 J.  $80^\circ$   
 K.  $100^\circ$

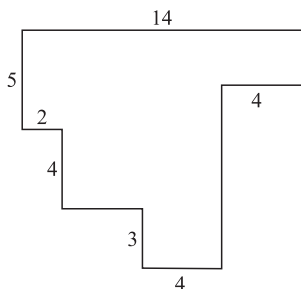
DO YOUR FIGURING HERE.

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41. In the figure shown below, each pair of intersecting line segments meets at a right angle, and all the lengths are given in inches. What is the perimeter, in inches, of the figure?



DO YOUR FIGURING HERE.

- A. 30  
B. 36  
C. 42  
D. 52  
E. 62
42. Of the 517 graduating seniors at Brighton High School, approximately  $\frac{4}{5}$  will be attending college, and approximately  $\frac{1}{2}$  of those going to college will be attending a state college. Which of the following is the closest estimate of the number of graduating seniors who will be attending a state college?
- F. 170  
G. 200  
H. 260  
J. 300  
K. 320
43. Let  $x \square y = (x - 2y)^2$  for all integers  $x$  and  $y$ . Which of the following is the value of  $5 \square (-3)$ ?
- A. 121  
B. 64  
C. 41  
D. 1  
E. -31
44. If 125% of a number is 425, what is 65% of the number?
- F. 221  
G. 276  
H. 284  
J. 308  
K. 340
45. What is the distance in the standard  $(x, y)$  coordinate plane between the points  $(2, 3)$  and  $(5, 5)$ ?
- A. 3  
B. 5  
C.  $\sqrt{11}$   
D.  $\sqrt{13}$   
E.  $\sqrt{25}$

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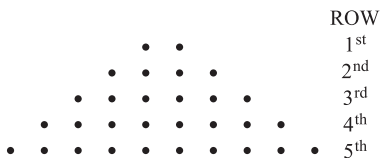
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46. The ratio of the radii of two circles is 9:16. What is the ratio of their circumferences?
- F. 3:4  
G. 9:16  
H. 18:32  
J.  $3:4\pi$   
K.  $9\pi:16$

DO YOUR FIGURING HERE.

47. A circle in the standard  $(x, y)$  coordinate plane is tangent to the  $x$ -axis at 4 and tangent to the  $y$ -axis at 4. Which of the following is an equation of the circle?
- A.  $x^2 + y^2 = 4$   
B.  $x^2 + y^2 = 16$   
C.  $(x - 4)^2 + (y - 4)^2 = 4$   
D.  $(x - 4)^2 + (y - 4)^2 = 16$   
E.  $(x + 4)^2 + (y + 4)^2 = 16$
48. Using the complex number  $i$ , where  $i^2 = -1$ ,  
 $\frac{2}{(1 - i)} \times \frac{(1 + i)}{(1 + i)} = ?$
- F.  $1 + i$   
G.  $i - 1$   
H.  $1 - i$   
J.  $2(1 + i)$   
K.  $2(1 - i)$

49. Which of the following describes the total number of dots in the first  $n$  rows of the triangular arrangement below?



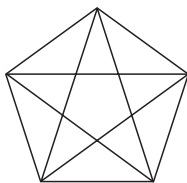
- A. 30  
B.  $2n$   
C.  $n^2$   
D.  $n(n + 1)$   
E.  $2n + 2(n - 1)$
50. After polling a class of 24 students by a show of hands, you find that 9 students play soccer and 21 students play basketball. Given that information, what is the number of students in the class who must play both soccer and basketball?
- F. 0  
G. 1  
H. 3  
J. 6  
K. 9

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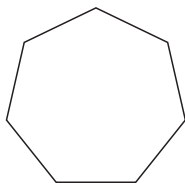
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51. Which of the following is the set of all real numbers  $x$  such that  $x + 2 > x + 5$  ?
- A. The set containing only zero
  - B. The set containing all nonnegative real numbers
  - C. The set containing all negative real numbers
  - D. The set containing all real numbers
  - E. The empty set

52. Pentagons have 5 diagonals, as illustrated below. How many diagonals does the heptagon (7 sides) below have?



Pentagon



Heptagon

- F. 7
  - G. 12
  - H. 14
  - J. 21
  - K. 28
53. John wants to draw a circle graph showing his friends' favorite ice cream flavors. When he polled his friends asking each their favorite flavor of ice cream, 35% of his friends said chocolate, 20% of his friends said vanilla, 15% of his friends said strawberry, 25% of his friends said mint chocolate chip, and 5% of his friends said flavors other than those previously listed. What will be the degree measure of the vanilla sector of the circle graph?
- A.  $126^\circ$
  - B.  $108^\circ$
  - C.  $90^\circ$
  - D.  $72^\circ$
  - E.  $36^\circ$

**DO YOUR FIGURING HERE.**

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54. If  $\sin \theta = \frac{4}{5}$  and  $\frac{\pi}{2} < \theta < \pi$ , then  $\tan \theta = ?$

F.  $-\frac{5}{4}$

G.  $-\frac{4}{3}$

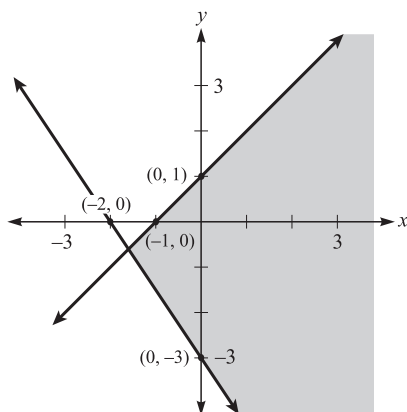
H.  $-\frac{3}{5}$

J.  $\frac{4}{3}$

K.  $\frac{3}{4}$

DO YOUR FIGURING HERE.

55. Which of the following systems of inequalities is represented by the shaded region of the graph below?



A.  $y \leq x + 1$  or  $y \geq x - 3$

B.  $y \leq x + 1$  and  $y \geq x - 3$

C.  $y \leq x + 1$  or  $y \geq \left(-\frac{3}{2}\right)x - 3$

D.  $y \leq x + 1$  and  $y \leq \left(-\frac{3}{2}\right)x - 3$

E.  $y \leq x + 1$  and  $y \geq \left(-\frac{3}{2}\right)x - 3$

56. If  $f(x) = 2x^2 + 3$ , then  $f(x + h) = ?$

F.  $2x^2 + h^2$

G.  $2x^2 + h + 3$

H.  $2x^2 + 2h^2 + 3$

J.  $x^2 + 2xh + h^2 + 3$

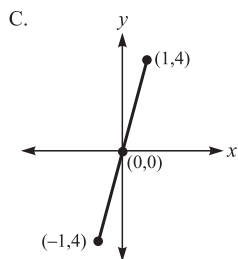
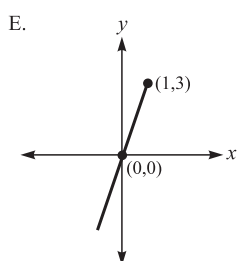
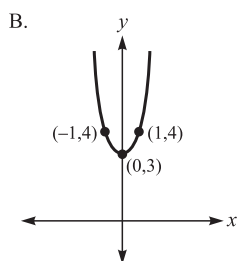
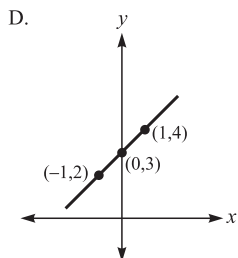
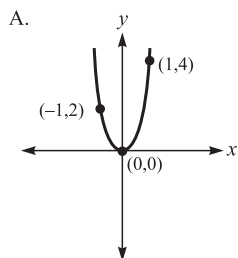
K.  $2x^2 + 4xh + 2h^2 + 3$

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57. Which of the following is the graph, in the standard  $(x, y)$  coordinate plane, of  $y = \frac{x^2 + 3x}{x}$ ?

**DO YOUR FIGURING HERE.**



58. A triangle,  $\triangle ABD$ , is reflected across the  $y$ -axis to have the image  $\triangle A'B'D'$  in the standard  $(x, y)$  coordinate plane: thus  $A$  reflects to  $A'$ . The coordinates of point  $A$  are  $(m, n)$ . What are the coordinates of point  $A'$ ?

- F.  $(-m, n)$
- G.  $(m, -n)$
- H.  $(-m, -n)$
- J.  $(n, m)$
- K. Cannot be determined from the given information.

**2****2**

59. If  $x = 3r - 4$  and  $y = 3r + 2$ , which of the following expresses  $y$  in terms of  $x$ ?
- A.  $y = x + 2$   
 B.  $y = x + 6$   
 C.  $y = 9r + 14$   
 D.  $y = 6r - 2$   
 E.  $y = 3x + 14$

**DO YOUR FIGURING HERE.**

60. What is  $\cos \frac{\pi}{12}$  given that  $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$  and that  $\cos(\alpha - \beta) = (\cos \alpha)(\cos \beta) + (\sin \alpha)(\sin \beta)$ ?

$\theta$	$\sin \theta$	$\cos \theta$
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$

- F.  $\frac{1}{4}$   
 G.  $\frac{1}{2}$   
 H.  $\frac{\sqrt{6} + \sqrt{2}}{4}$   
 J.  $\frac{\sqrt{3} + \sqrt{2}}{2}$   
 K.  $\frac{\sqrt{6} + 2}{4}$

**END OF THE MATHEMATICS TEST.  
 STOP! IF YOU HAVE TIME LEFT OVER, CHECK YOUR WORK ON THIS SECTION ONLY.**