



## 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. Which of the following expressions is equivalent to  $a(4 - a) - 5(a + 7)$ ?

- A.  $-2a - 35$
- B.  $-2a + 7$
- C.  $-a^2 - a - 35$
- D.  $-a^2 - a + 7$
- E.  $-2a^3 - 35$

2. Which of the following inequalities orders the numbers 0.2, 0.03, and  $\frac{1}{4}$  from least to greatest?

- F.  $0.2 < 0.03 < \frac{1}{4}$
- G.  $0.03 < 0.2 < \frac{1}{4}$
- H.  $0.03 < \frac{1}{4} < 0.2$
- J.  $\frac{1}{4} < 0.03 < 0.2$
- K.  $\frac{1}{4} < 0.2 < 0.03$

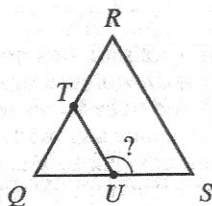
3. If  $x^2 + 4 = 29$ , then  $x^2 - 4 = ?$

- A. 5
- B.  $\sqrt{21}$
- C. 21
- D. 25
- E. 33

**DO YOUR FIGURING HERE.**



4. In the figure below,  $\triangle QRS$  is equilateral, side  $\overline{QR}$  is bisected by  $T$ , and side  $\overline{QS}$  is bisected by  $U$ . What is the degree measure of  $\angle TUS$ ?



- F.  $60^\circ$   
 G.  $90^\circ$   
 H.  $120^\circ$   
 J.  $135^\circ$   
 K.  $150^\circ$

5. A line in the standard  $(x,y)$  coordinate plane passes through the points  $(-3,4)$  and  $(2,-5)$ . The slope of the line:

- A. is positive.  
 B. is zero.  
 C. is negative.  
 D. is undefined.  
 E. cannot be determined from the given information.

6. The square root of a certain number is approximately 9.2371. The certain number is between what 2 integers?

- F. 3 and 4  
 G. 4 and 5  
 H. 9 and 10  
 J. 18 and 19  
 K. 81 and 99

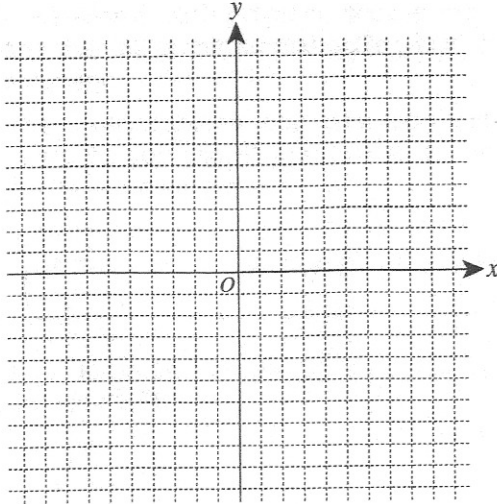
7. A bag contains 10 pieces of flavored candy: 4 lemon, 3 strawberry, 2 grape, and 1 cherry. One piece of candy will be randomly picked from the bag. What is the probability the candy picked is NOT grape flavored?

- A.  $\frac{1}{5}$   
 B.  $\frac{1}{4}$   
 C.  $\frac{1}{2}$   
 D.  $\frac{3}{4}$   
 E.  $\frac{4}{5}$

DO YOUR FIGURING HERE.



8. When points  $A$  and  $B(-3,4)$  are graphed in the standard  $(x,y)$  coordinate plane below, the midpoint of  $\overline{AB}$  will be  $(1,2)$ . What will be the coordinates of point  $A$ ?



DO YOUR FIGURING HERE.

- F.  $(-7,6)$   
 G.  $(-2,1)$   
 H.  $(-1,3)$   
 J.  $(-1,8)$   
 K.  $(5,0)$
9. Andrea manages a company that currently has 116 customers, which is 8 more than twice the number of customers the company had 1 year ago. How many customers did the company have 1 year ago?
- A. 50  
 B. 54  
 C. 62  
 D. 66  
 E. 100
10. Joseph will have a 200-foot-long fence installed around his yard. The A+ Fence Company charges a \$500.00 fee, plus a set amount per foot of fence. The A+ Fence Company has given Joseph an estimate of \$2,200.00 to install the fence around his yard. What is the set amount per foot of fence?
- F. \$ 4.00  
 G. \$ 4.80  
 H. \$ 8.50  
 J. \$11.00  
 K. \$13.50
11. Which of the following expressions is equivalent to  $(3x + 6)(2x - 1)$ ?
- A.  $15x - 6$   
 B.  $15x - 1$   
 C.  $6x^2 - 6$   
 D.  $6x^2 + 9x - 6$   
 E.  $6x^2 + 12x - 6$



Use the following information to answer questions 12–14.

Carrie's Chocolate Shop and Tamika's Treat Shop both sell candy in boxes. The table below lists the price (the total amount the customer pays) of each box of candy sold at the shops. For each shop, there is a linear relationship between the price of a box of candies and the number of candies in that box. These are the only numbers of candies that can be purchased at the shops.

Candies per box ( $n$ )	Price at Carrie's Chocolate Shop ( $c$ )	Price at Tamika's Treat Shop ( $t$ )
5	\$1.50	\$2.25
10	\$2.50	\$2.75
15	\$3.50	\$3.25
20	\$4.50	\$3.75
25	\$5.50	\$4.25
30	\$6.50	\$4.75

12. Jeremy has \$10.00 in quarters to spend on candy. What is the maximum number of quarters he would have left after paying for a box of 25 candies at Tamika's Treat Shop?

(Note: Each quarter is worth \$0.25.)

- F. 10  
 G. 17  
 H. 22  
 J. 23  
 K. 30
13. At Tamika's Treat Shop, what is the average price per candy in a box of 20, to the nearest \$0.01?
- A. \$0.08  
 B. \$0.19  
 C. \$0.23  
 D. \$0.30  
 E. \$0.45
14. Which of the following equations gives the relationship between the price in dollars,  $c$ , and the number of candies,  $n$ , in a box of candies at Carrie's Chocolate Shop?
- F.  $c = 0.2n + 0.5$   
 G.  $c = 0.3n$   
 H.  $c = 0.5n + 1.5$   
 J.  $c = n - 3.5$   
 K.  $c = 1.4n - 5.5$

DO YOUR FIGURING HERE.

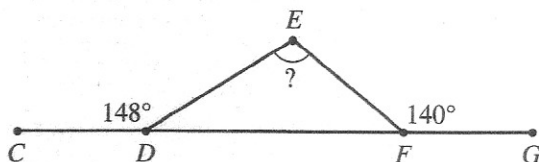




15. Mr. Chang made the true statement "At least 1 student in this class is a section leader in the band." Which of the following statements *must* be FALSE?

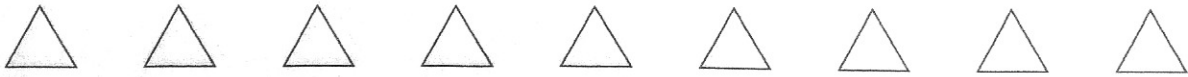
- A. At most 1 student in this class is not a section leader in the band.
- B. Most students in this class are section leaders in the band.
- C. Every student in this class is a section leader in the band.
- D. Some students in this class are not section leaders in the band.
- E. No student in this class is a section leader in the band.

16. In the figure below, vertices  $D$  and  $F$  of  $\triangle DEF$  lie on  $\overline{CG}$ , the measure of  $\angle CDE$  is  $148^\circ$ , and the measure of  $\angle EFG$  is  $140^\circ$ . What is the measure of  $\angle DEF$ ?

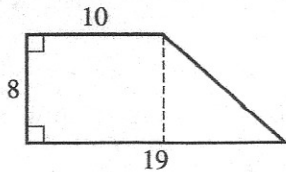


- F.  $72^\circ$
  - G.  $98^\circ$
  - H.  $100^\circ$
  - J.  $108^\circ$
  - K.  $116^\circ$
17. A company ships notepads in rectangular boxes that each have inside dimensions measuring 9 inches long, 9 inches wide, and 12 inches tall. Each notepad is in the shape of a cube with an edge length of 3 inches. What is the maximum number of notepads that will fit in 1 closed box?
- A. 10
  - B. 11
  - C. 12
  - D. 22
  - E. 36
18. The function  $f$  is defined as  $f(x) = -4x^3 - 4x^2$ . What is  $f(-4)$ ?
- F. -320
  - G. -192
  - H. 16
  - J. 192
  - K. 320
19. Which of the following  $(x,y)$  pairs is the solution for the system of equations  $x + 2y = 4$  and  $-2x + y = 7$ ?
- A.  $(-2,3)$
  - B.  $(-1,2.5)$
  - C.  $(1,1.5)$
  - D.  $(2,1)$
  - E.  $(4,0)$

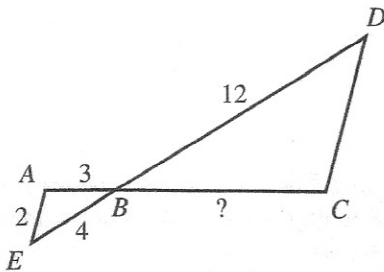
## DO YOUR FIGURING HERE.



20. The floor plan of Helena's kitchen is shown in the figure below; the given dimensions are in feet. Helena will install baseboard along the bottom of each wall (shown by solid lines in the floor plan). According to the floor plan, which of the following distances is closest to the perimeter, in feet, of Helena's kitchen?

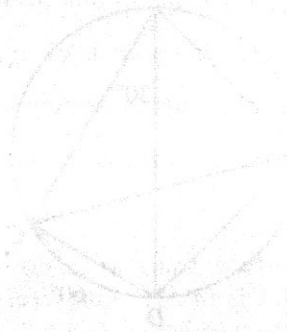


- F. 40  
G. 50  
H. 60  
J. 100  
K. 120
21. A 5-inch-by-7-inch photograph was cut to fit exactly into a 4-inch-by-6-inch frame. What is the area, in square inches, of the part of the photograph that was cut off?
- A. 2  
B. 10  
C. 11  
D. 12  
E. 24
22. In the figure shown below,  $\overline{AE} \parallel \overline{DC}$ ,  $\overline{AC}$  and  $\overline{DE}$  intersect at  $B$ , and the given lengths are in feet. What is the length, in feet, of  $\overline{BC}$ ?



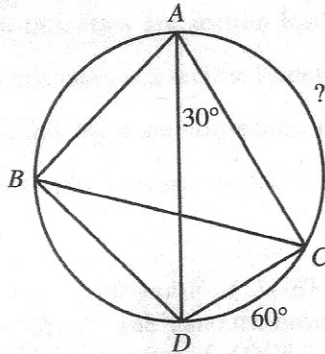
- F. 6  
G. 8  
H. 9  
J. 10  
K. 11
23. Given that  $x \leq 4$  and  $x + y \geq 5$ , what is the LEAST value that  $y$  can have?
- A. -9  
B. -1  
C. 0  
D. 1  
E. 9

DO YOUR FIGURING HERE.





24. The circle shown below has diameter  $\overline{AD}$ , and points  $B$  and  $C$  lie on the circle. The measure of  $\angle CAD$  is  $30^\circ$ , and the measure of minor arc  $\widehat{CD}$  is  $60^\circ$ . What is the measure of minor arc  $\widehat{AC}$  ?



- F.  $75^\circ$   
 G.  $90^\circ$   
 H.  $105^\circ$   
 J.  $120^\circ$   
 K.  $150^\circ$

25. One caution sign flashes every 4 seconds, and another caution sign flashes every 10 seconds. At a certain instant, the 2 signs flash at the same time. How many seconds elapse until the 2 signs next flash at the same time?

- A. 6  
 B. 7  
 C. 14  
 D. 20  
 E. 40

26. For all nonzero values of  $a$  and  $b$ , the value of which of the following expressions is *always* negative?

- F.  $a - b$   
 G.  $-a - b$   
 H.  $|a| + |b|$   
 J.  $|a| - |b|$   
 K.  $-|a| - |b|$

27. Graphed in the same standard  $(x,y)$  coordinate plane are a circle and a parabola. The circle has radius 3 and center  $(0,0)$ . The parabola has vertex  $(-3,-2)$ , has a vertical axis of symmetry, and passes through  $(-2,-1)$ . The circle and the parabola intersect at how many points?

- A. 0  
 B. 1  
 C. 2  
 D. 3  
 E. 4

28. 40% of 250 is equal to 60% of what number?

- F. 150  
 G. 160  
 H.  $166\frac{2}{3}$   
 J. 270  
 K. 375

DO YOUR FIGURING HERE.





29. Which of the following inequalities is equivalent to  $-2x - 6y > 2y - 4$ ?

- A.  $x < -4y + 2$
- B.  $x > -4y + 2$
- C.  $x < 2y + 2$
- D.  $x < 4y + 2$
- E.  $x > 4y + 2$

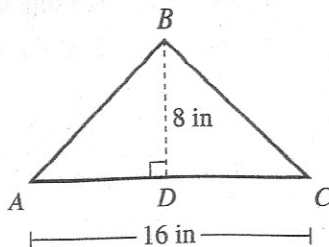
30. For an angle with measure  $\alpha$  in a right triangle,  $\sin \alpha = \frac{40}{41}$  and  $\tan \alpha = \frac{40}{9}$ . What is the value of  $\cos \alpha$ ?

- F.  $\frac{9}{41}$
- G.  $\frac{41}{9}$
- H.  $\frac{9}{40}$
- J.  $\frac{9}{\sqrt{1,519}}$
- K.  $\frac{9}{\sqrt{3,281}}$

31. The perimeter of rectangle  $ABCD$  is 96 cm. The ratio of the side lengths  $AB:BC$  is 3:5. What is the length, in centimeters, of  $AB$ ?

- A. 6
- B. 18
- C. 30
- D. 36
- E. 60

32. For  $\triangle ABC$  shown below, base  $\overline{AC}$  has a length of 16 inches and altitude  $\overline{BD}$  has a length of 8 inches. The area of a certain square is equal to the area of  $\triangle ABC$ . What is the length, in inches, of a side of the square?



- F. 6
- G. 8
- H. 12
- J. 16
- K. 32

### DO YOUR FIGURING HERE.



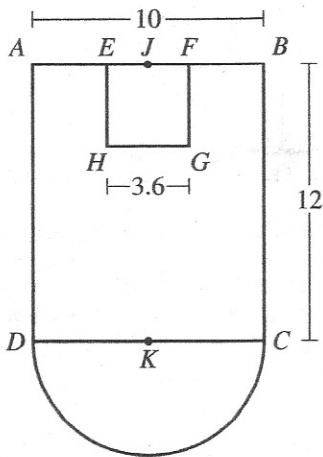




Use the following information to answer questions 33–36.

DO YOUR FIGURING HERE.

In the figure shown below,  $ABCD$  is a rectangle,  $EFGH$  is a square, and  $\overline{CD}$  is the diameter of a semicircle. Point  $K$  is the midpoint of  $\overline{CD}$ . Point  $J$  is the midpoint of both  $\overline{AB}$  and  $\overline{EF}$ . Points  $E$  and  $F$  lie on  $\overline{AB}$ . The 3 given lengths are in meters.



33. The length of  $\overline{EH}$  is what percent of the length of  $\overline{AD}$  ?

- A. 15.6%
- B. 30%
- C. 36%
- D. 43.2%
- E. 50%

34. What is the length, in meters, of  $\overline{JD}$  ?

- F. 13
- G. 15.6
- H. 17
- J.  $\sqrt{44}$
- K.  $\sqrt{244}$

35. What is the length, in meters, of arc  $\widehat{CD}$  ?

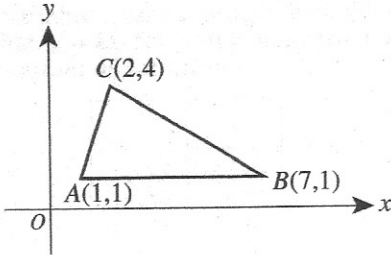
- A.  $2.5\pi$
- B.  $5\pi$
- C.  $6.25\pi$
- D.  $10\pi$
- E.  $25\pi$

36. The figure will be placed in the standard  $(x,y)$  coordinate plane so that  $K$  is at the origin,  $\overline{AB}$  is parallel to the  $x$ -axis, and 1 meter equals 1 coordinate unit. Which of the following values could be the  $y$ -coordinate of  $H$  ?

- F. 1.8
- G. 3.6
- H. 8.4
- J. 10
- K. 12



37. What is the length, in coordinate units, of the altitude from  $C$  to  $\overline{AB}$  in  $\triangle ABC$  shown in the standard  $(x,y)$  coordinate plane below?



- A. 3  
 B. 5  
 C. 6  
 D.  $\sqrt{10}$   
 E.  $\sqrt{13}$
38. At a local post office, on average, 3 customers are in line when the post office closes each day. The probability,  $P$ , that exactly  $n$  customers are in line when the post office closes can be modeled by the equation  $P = \frac{3^n e^{-3}}{n!}$ . Given that  $e^{-3} \approx 0.05$ , which of the following values is closest to the probability that exactly 2 customers are in line when the post office closes?

- F. 0.08  
 G. 0.11  
 H. 0.15  
 J. 0.23  
 K. 0.45

39. What is the amplitude of the function

$$f(x) = \frac{1}{2} \cos(3x + \pi) ?$$

- A.  $\frac{1}{3}$   
 B.  $\frac{1}{2}$   
 C.  $\frac{3}{2}$   
 D. 2  
 E. 3

DO YOUR FIGURING HERE.



40. A sphere with radius  $x$  inches has a volume of 12 cubic inches. What is the value of  $x$ ?

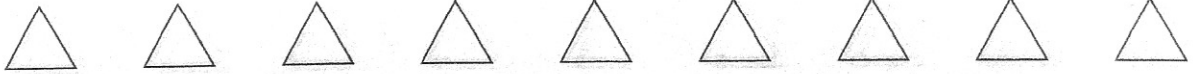
(Note: The volume of a sphere with radius  $r$  is  $\frac{4}{3}\pi r^3$ .)

- F.  $\frac{1}{\pi}$   
 G.  $\frac{3}{\pi}$   
 H.  $\sqrt[3]{\frac{9}{\pi}}$   
 J.  $\sqrt[3]{\frac{16}{\pi}}$   
 K.  $\sqrt[3]{9\pi}$
41. For 20 quiz scores in a typing class, the table below gives the frequency of the scores in each score interval. Which score interval contains the median of the scores?

Score interval	Frequency
96–100	3
91–95	1
86–90	3
81–85	4
76–80	9

- A. 96–100  
 B. 91–95  
 C. 86–90  
 D. 81–85  
 E. 76–80
42. The angle of elevation to the top of a tree from a spot on level ground 50 feet from the base of the tree is  $40^\circ$ . Which of the following is closest to the height of the tree, in feet?  
 (Note:  $\sin 40^\circ \approx 0.64$ ,  $\cos 40^\circ \approx 0.77$ ,  $\tan 40^\circ \approx 0.84$ )
- F. 32  
 G. 38  
 H. 42  
 J. 60  
 K. 65
43. 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.

DO YOUR FIGURING HERE.



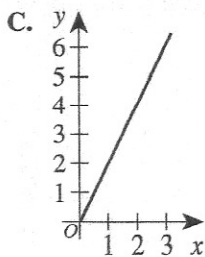
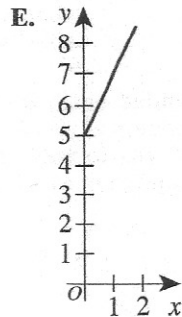
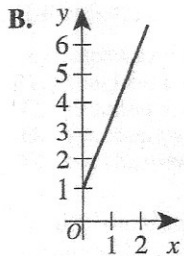
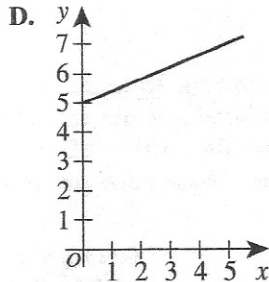
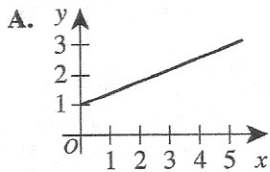
44. The table below gives experimental data values for variables  $x$  and  $y$ . Theory predicts that  $y$  varies directly with  $x$ . Based on the experimental data, which of the following values is closest to the constant of variation?

(Note: The variable  $y$  varies directly with the variable  $x$  provided that  $y = kx$  for some nonzero constant  $k$ , called the *constant of variation*.)

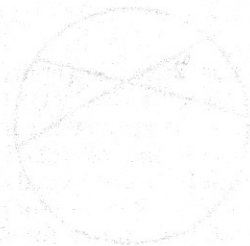
$x$	$y$
2.75	0.140
8.50	0.425
14.75	0.750
16.75	0.850
21.00	1.050

- F. -2.61
- G. 0.05
- H. 3.61
- J. 15.90
- K. 20.00

45. During a snowstorm, the relationship between the depth of accumulated snow,  $y$  inches, and the elapsed time,  $x$  hours, was modeled by the equation  $2x - 5y = -5$ . One of the following graphs in the standard  $(x,y)$  coordinate plane models the equation for positive values of  $x$  and  $y$ . Which one?



**DO YOUR FIGURING HERE.**





46. Diana is baking bread, and the original recipe calls for  $1\frac{1}{2}$  teaspoons of yeast and  $2\frac{1}{2}$  cups of flour. Diana will use the entire contents of a packet that contains  $2\frac{1}{4}$  teaspoons of yeast and will use the same ratio of ingredients called for in the original recipe. How many cups of flour will Diana use?

- F.  $1\frac{7}{8}$   
 G.  $3\frac{1}{4}$   
 H.  $3\frac{1}{2}$   
 J.  $3\frac{3}{4}$   
 K. 4

47. For all nonzero values of  $x$ ,  $\frac{12x^6 - 9x^2}{3x^2} = ?$

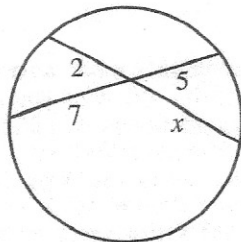
- A.  $4x^3 - 3x$   
 B.  $4x^3 - 3$   
 C.  $4x^4 - 9x^2$   
 D.  $4x^4 - 3x$   
 E.  $4x^4 - 3$

48. Four matrices are given below.

$$W = \begin{bmatrix} 1 & 2 \\ 5 & 8 \end{bmatrix} \quad X = \begin{bmatrix} 3 & 9 \\ 7 & 4 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 6 \end{bmatrix} \quad Z = \begin{bmatrix} 5 & 8 \\ 2 & 9 \\ 3 & 7 \end{bmatrix}$$

Which of the following matrix products is undefined?

- F.  $WX$   
 G.  $WY$   
 H.  $YZ$   
 J.  $XW$   
 K.  $XZ$
49. A circle, 2 chords, and some lengths, in centimeters, are shown in the figure below, which is not drawn to scale. What is the value of  $x$ ?



(Note: When two chords intersect, the product of the lengths of the segments of one chord equals the product of the lengths of the segments of the other chord.)

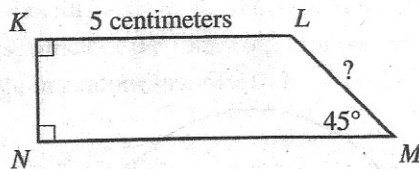
- A. 10  
 B. 13.5  
 C. 14  
 D. 17.5  
 E. 19

DO YOUR FIGURING HERE.



50. If the area of  $KLMN$  in the figure below is 12 square centimeters, what is the length, in centimeters, of  $\overline{LM}$  ?

- F.  $2\sqrt{2}$   
 G.  $5\sqrt{2}$   
 H.  $6\sqrt{2}$   
 J.  $2\sqrt{3}$   
 K.  $\frac{12}{5}\sqrt{3}$



51. A teacher assigns each of her 18 students a different integer from 1 through 18. The teacher forms pairs of study partners by using the rule that the sum of the pair of numbers is a perfect square. Assuming the 9 pairs of students follow this rule, the student assigned which number *must* be paired with the student assigned the number 1 ?

- A. 16  
 B. 15  
 C. 9  
 D. 8  
 E. 3

52. Given that  $(x + 2)$  and  $(x - 1)$  are factors of the quadratic expression below, what are the values of  $a$  and  $b$  ?

$$x^2 + (a + 2)x + a + b$$

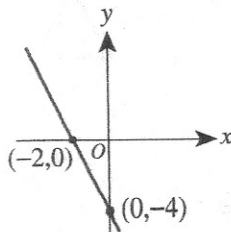
- |    | $\frac{a}{b}$ | $\frac{b}{a}$ |
|----|---------------|---------------|
| F. | -4            | 5             |
| G. | -3            | 1             |
| H. | -3            | 5             |
| J. | -1            | 3             |
| K. | -1            | -1            |

53. The height above the ground,  $h$  units, of an object  $t$  seconds after being thrown from the top of a building is given by the equation  $h = -2t^2 + 10t + 48$ . An equivalent factored form of this equation shows that the object:

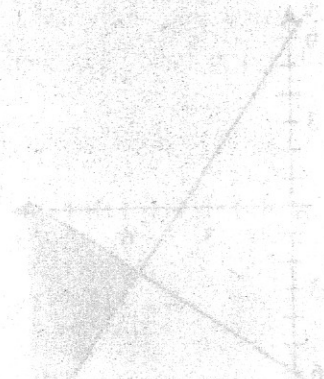
- A. starts at a point 2 units off the ground.  
 B. reaches a maximum height of 3 units.  
 C. reaches a maximum height of 8 units.  
 D. reaches the ground at 3 seconds.  
 E. reaches the ground at 8 seconds.

54. In the standard  $(x, y)$  coordinate plane below, the line through the points  $(-2, 0)$  and  $(0, -4)$  is graphed. Which of the following values is the slope of any line that is in this plane and is perpendicular to the graphed line?

- F. -2  
 G. -1  
 H. -0.5  
 J. 0.5  
 K. 1

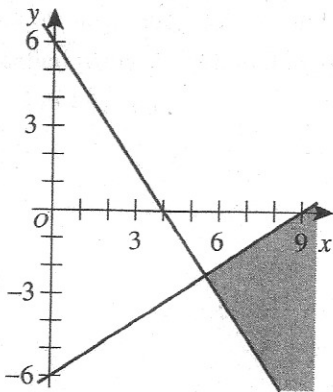


DO YOUR FIGURING HERE.





55. The shaded portion of the graph in the standard  $(x,y)$  coordinate plane below represents the solution set of one of the following systems of linear inequalities. Which one?



DO YOUR FIGURING HERE.

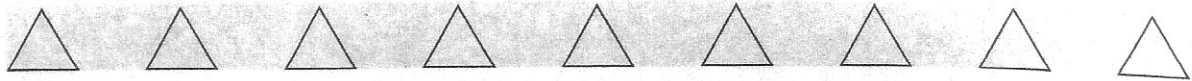
- A.  $y \leq \frac{2}{3}x - 6$  and  $y \geq -\frac{3}{2}x + 6$   
 B.  $y \geq \frac{2}{3}x - 6$  and  $y \geq -\frac{3}{2}x + 6$   
 C.  $y \geq \frac{2}{3}x - 6$  and  $y \leq -\frac{3}{2}x + 6$   
 D.  $y \leq \frac{3}{2}x - 6$  and  $y \geq -\frac{2}{3}x + 6$   
 E.  $y \geq \frac{3}{2}x - 6$  and  $y \leq -\frac{2}{3}x + 6$

56. Whenever  $j$  and  $k$  are positive integers such that  $(\sqrt{3})^j = 27^k$ , what is the value of  $\frac{j}{k}$ ?

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

57. A finite arithmetic sequence has 7 terms, and the first term is  $\frac{3}{4}$ . What is the difference between the mean and the median of the 7 terms?

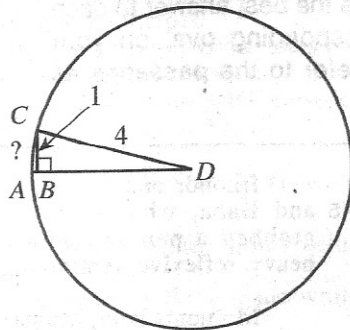
- A. 0  
 B.  $\frac{3}{4}$   
 C.  $\frac{4}{3}$   
 D. 3  
 E. 4



58. In the circle with center  $D$  shown below, the length of radius  $\overline{CD}$  is 4 cm, the length of  $\overline{BC}$  is 1 cm, and  $\overline{BC}$  is perpendicular to radius  $\overline{AD}$  at  $B$ . When  $\angle ADC$  is measured in degrees, which of the following expressions represents the length, in centimeters, of  $\overline{AC}$ ?

**DO YOUR FIGURING HERE.**

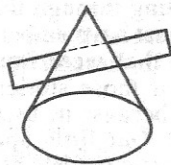
- F.  $\frac{\pi}{45} \left( \sin^{-1} \left( \frac{1}{4} \right) \right)$
- G.  $\frac{\pi}{45} \left( \cos^{-1} \left( \frac{1}{4} \right) \right)$
- H.  $\frac{2\pi}{45} \left( \sin^{-1} \left( \frac{1}{4} \right) \right)$
- J.  $\frac{2\pi}{45} \left( \cos^{-1} \left( \frac{1}{4} \right) \right)$
- K.  $\frac{2\pi}{45} \left( \tan^{-1} \left( \frac{1}{4} \right) \right)$



59. Which of the following linear equations gives the vertical asymptote for the graph of  $y = \frac{201x + 202}{203x + 204}$  in the standard  $(x,y)$  coordinate plane?

- A.  $x = -\frac{201}{203}$
- B.  $x = -\frac{202}{201}$
- C.  $x = -\frac{202}{204}$
- D.  $x = -\frac{204}{203}$
- E.  $x = -\frac{403}{407}$

60. A right circular cone is intersected by a plane that is not parallel to the base and does not intersect the base or vertex, as shown in the figure below. One of the following figures shows the shape of the intersection. Which figure is it?



- F.
- G.
- H.
- J.
- K.

**END OF TEST 2**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.  
DO NOT RETURN TO THE PREVIOUS TEST.**