



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. Bella sells real estate. She is paid 3% of the sale price of every house she sells. What is Bella paid for selling a house at the sale price of \$250,000 ?

- A. \$ 300
- B. \$ 2,500
- C. \$ 3,000
- D. \$ 7,500
- E. \$75,000

2. For what value(s) of x is $(x + 3)(x - 4) = 0$ true?

- F. -3 and 4
- G. -3 only
- H. 3 and -4
- J. 3 only
- K. 4 only

3. Which of the following inequalities orders the numbers 0.1, 0.04, and $\frac{1}{6}$ from least to greatest?

- A. $0.1 < 0.04 < \frac{1}{6}$
- B. $0.04 < 0.1 < \frac{1}{6}$
- C. $0.04 < \frac{1}{6} < 0.1$
- D. $\frac{1}{6} < 0.04 < 0.1$
- E. $\frac{1}{6} < 0.1 < 0.04$

4. Given that $2x + 1 = 5$, what is the value of $(x + 3)^3$?

- F. 15
- G. 18
- H. 125
- J. 216
- K. 729

DO YOUR FIGURING HERE.



5. What vector is the result of adding the vectors $\langle 1, -2 \rangle$, $\langle 2, 3 \rangle$, and $\langle -4, 2 \rangle$?

A. $\langle -8, -12 \rangle$
 B. $\langle -1, 3 \rangle$
 C. $\langle 3, -3 \rangle$
 D. $\langle 7, -1 \rangle$
 E. $\langle 7, 7 \rangle$

6. What value of x makes $\frac{2}{3}x + 5 = 11$ true?

F. 4
 G. $5\frac{1}{3}$
 H. 9
 J. $10\frac{2}{3}$
 K. 24

7. In Summit City, the daily low temperatures, in degrees Fahrenheit ($^{\circ}\text{F}$), during the first week in December were -7 , -11 , 15 , 23 , 45 , 23 , and 2 . To the nearest 1°F , what was the mean daily low temperature for that week?

A. 11°F
 B. 13°F
 C. 15°F
 D. 18°F
 E. 23°F

8. Assume that a , b , and c are real numbers. If $a > b$, and $(a + c) > (b + c)$, then what is true of c ?

F. c must have the same sign as a .
 G. c must have the same sign as b .
 H. c must be negative.
 J. c must be positive.
 K. c can be any real number.

9. What is the slope of the line given by the equation $2x + 7y = -12$?

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

DO YOUR FIGURING HERE.

3	4	5	6	7	8	9	10
10	11	12	13	14	15	16	17



10. One leg of a right triangle is 4 meters long and the other leg is 8 meters long. The hypotenuse of the triangle is how many meters long?

F. 12
 G. 16
 H. 40
 J. $\sqrt{24}$
 K. $\sqrt{80}$

DO YOUR FIGURING HERE.

11. Students studying motion observed a cart rolling at a constant rate along a straight line. The table below gives the distance, d feet, the cart was from a reference point at 1-second intervals from $t = 0$ seconds to $t = 5$ seconds.

t	0	1	2	3	4	5
d	10	18	26	34	42	50

Which of the following equations represents this relationship between d and t ?

- A. $d = t + 10$
 B. $d = 8t + 2$
 C. $d = 8t + 10$
 D. $d = 10t + 8$
 E. $d = 28t$
12. The ratio of 30 to 24 is the same as the ratio of 40 to what number?
- F. 14
 G. 32
 H. 34
 J. 46
 K. 50

13. A box contains 3 red, 2 white, and 5 blue beads, each of which is a solid color. Miguel will randomly remove 1 bead from the box, record the color of the bead, and return the bead to the box. Miguel will complete this process 50 times. How many times should Miguel expect to record a bead color that is NOT white?

A. 10
 B. 15
 C. 25
 D. 40
 E. 50



14. Whenever $3(a + 6b) - c = 0$, which of the following expressions is equal to a ?

F. $\frac{c}{3} - 6b$

G. $\frac{c}{3} - 2b$

H. $2b - \frac{c}{3}$

J. $c - 6b$

K. $3c - 6b$

15. Given that $\sqrt{2x} - 9 = 1$, $x = ?$

A. -32

B. 20

C. 25

D. 32

E. 50

16. A high school ice hockey conference that consists of 10 teams requires that every conference team must play each of the other conference teams at least once in a season. For n teams in the conference, the number of conference games played in a season must then be at least $\frac{n^2 - n}{2}$. What is the minimum number of conference games that must be played in a season for this conference?

F. 15

G. 40

H. 45

J. 50

K. 95

17. For an angle with measure α in a right triangle, $\sin \alpha = \frac{112}{113}$ and $\tan \alpha = \frac{112}{15}$. What is the value of $\cos \alpha$?

A. $\frac{15}{113}$

B. $\frac{15}{112}$

C. $\frac{15}{\sqrt{25,313}}$

D. $\frac{15}{\sqrt{12,319}}$

E. $\frac{113}{15}$

DO YOUR FIGURING HERE.



18. In isosceles triangle $\triangle ABC$, \overline{AB} is congruent to \overline{BC} and the measure of the vertex angle, $\angle B$, is 75° . What is the measure of $\angle A$?

F. 7.5°
 G. 15°
 H. 52.5°
 J. 75°
 K. 105°

19. *Cowling's rule* is a method of calculating a medication dosage for a child by using the child's age and the adult dosage. The rule uses the formula $d = a\left(\frac{t+1}{24}\right)$, where d is the child's dosage in milligrams, a is the adult dosage in milligrams, and t is the child's age in years. Dato is taking a 150-milligram dosage of medication that has an adult dosage of 300 milligrams. According to this rule, which of the following values is closest to Dato's age in years?

A. 9
 B. 11
 C. 12
 D. 13
 E. 19

20. Each side of a square is 3 cm long. One vertex of the square is at (4,2) on a square coordinate grid marked in centimeter units. Which of the following points on the grid could be another vertex of the square?

F. (7, 2)
 G. (5, 2)
 H. (2, 3)
 J. (1, -3)
 K. (-3, 2)

21. The Ferris wheel at a state fair has a radius of 60 feet, rotates at a constant speed, and completes 1 rotation in 4 minutes. How many degrees does the Ferris wheel rotate in 30 seconds?

A. 20°
 B. 24°
 C. 30°
 D. 45°
 E. 48°

DO YOUR FIGURING HERE.



22. At Gussie's Pizzeria, Odetta spends \$8.75 (before tax) on the purchase of 2 appetizers and 3 slices of pizza. The price of each slice of pizza is p dollars. The price of each appetizer is twice the price of a slice of pizza. Which of the following systems of equations, when solved, gives the price, a dollars, of an appetizer and the price, p dollars, of a slice of pizza at Gussie's?

F.
$$\begin{cases} 2a + 3p = 8.75 \\ a = 2p \end{cases}$$

G.
$$\begin{cases} 2a + p = 8.75 \\ 3a = 2p \end{cases}$$

H.
$$\begin{cases} 2p + a = 8.75 \\ 3p = 2a \end{cases}$$

J.
$$\begin{cases} 3a + 2p = 8.75 \\ p = 2a \end{cases}$$

K.
$$\begin{cases} 3p + a = 8.75 \\ a = 2p \end{cases}$$

23. The perimeter of a parallelogram is 76 inches, and the length of 1 side is 10 inches. If it can be determined, what are the lengths, in inches, of the other 3 sides?

A. 10, 10, 46

B. 10, 23, 23

C. 10, 28, 28

D. 10, 33, 33

E. Cannot be determined from the given information

24. John told Raquel that if he spent up to \$30 from his savings account, his savings account would have at least $\frac{3}{4}$ as much in it as it has now. From John's statement, Raquel can deduce that the *least* amount of money that John could have in his savings account now is:

F. \$ 30

G. \$ 40

H. \$ 90

J. \$100

K. \$120

DO YOUR FIGURING HERE.



Use the following information to answer questions 25–27.

At East High School, the 20 cast members of the spring musical sold 2 types of tickets—student and adult—for the Friday night and Saturday night performances. The price of each student ticket was \$2 and the price of each adult ticket was \$3. The table below gives the number of tickets sold, by type and by night.

Ticket Sales per Performance		
Ticket type	Night of performance	
	Friday	Saturday
Student	122	100
Adult	90	110

The stem-and-leaf plot below shows the number of tickets, regardless of type, sold by each of the 20 cast members.

Stem	Leaf
0	8 9
1	0 4 4 4 4 4 5 9
2	1 2 3 4 8 9
3	3 5 8 8

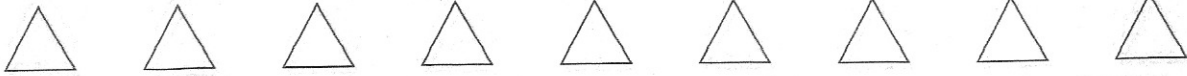
Key: 1 | 4 = 14 tickets

The auditorium where the spring musical will be performed has 10 seats in the 1st (front) row. Each row behind the 1st row has 4 more seats than does the row in front of it.

25. Suppose 1 cast member will be picked at random from the 20 cast members who sold tickets to receive a prize. What is the probability of picking a cast member who sold more than 30 tickets?

- A. $\frac{1}{5}$
 B. $\frac{1}{4}$
 C. $\frac{2}{19}$
 D. $\frac{2}{17}$
 E. $\frac{4}{5}$

DO YOUR FIGURING HERE.



26. For which night was the total amount collected for the tickets greater, and by how many dollars was it greater?

- F. Friday by \$5
- G. Friday by \$16
- H. Friday by \$26
- J. Saturday by \$16
- K. Saturday by \$26

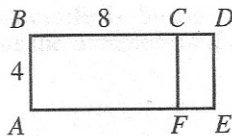
27. How many seats are in the 8th row of the auditorium?

- A. 38
- B. 42
- C. 46
- D. 66
- E. 74



28. In rectangle $ABDE$ shown below, C lies on \overline{BD} and F lies on \overline{AE} such that rectangles $ABCF$ and $CDEF$ are similar ($ABCF \sim CDEF$), the length of \overline{AB} is 4 cm, and the length of \overline{BC} is 8 cm. What is the area, in square centimeters, of $ABDE$?

- F. 32
- G. 38
- H. 40
- J. 42
- K. 48



29. Points A , B , C , and D lie on the real number line as shown below. The coordinate of B is 0, \overline{AC} is 15 units long, \overline{BD} is 20 units long, and \overline{AD} is 32 units long. What is the coordinate of C ?



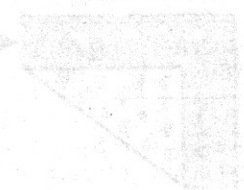
- A. 3
- B. 5
- C. 10
- D. 12
- E. 15

30. In a certain country, last year's population was estimated to be 3.6×10^6 people, and last year's public debt was estimated to be 1.8×10^9 dollars. Based on these estimates, what was last year's public debt per person in this country?

- F. \$ 0.05
- G. \$ 0.20
- H. \$ 500.00
- J. \$2,000.00
- K. \$5,000.00

DO YOUR FIGURING HERE.

[Faint, illegible text from the reverse side of the page is visible through the paper.]

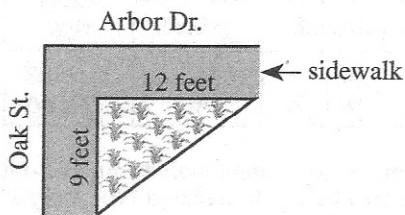


[Faint, illegible text from the reverse side of the page is visible through the paper.]



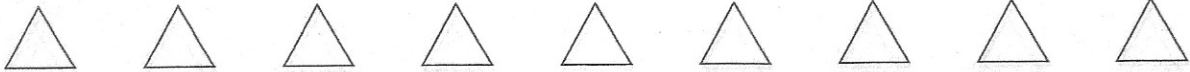
Use the following information to answer questions 31–34.

A landscaper will install a triangular garden near the intersection of 2 streets. In the plan of the garden shown below, the angle nearest the intersection is a right angle. The landscaper has purchased the following materials for the garden: 1 bag of fertilizer at a price of \$15.50, 50 plants at a price of \$0.70 each, and 3 bags of mulch at a price of \$4.00 each. An 8% sales tax was added to the total price of these materials. The landscaper will also install a water sprinkler that will be located an equal distance from the 3 vertices of the garden.



31. The landscaper calculated the area of the garden before purchasing the fertilizer, plants, and mulch. What is the area, in square feet, of the garden?
- A. 21
B. 42
C. 54
D. 81
E. 108
32. What was the total cost, including sales tax, of the fertilizer, plants, and mulch that the landscaper purchased?
- F. \$62.50
G. \$67.50
H. \$70.50
J. \$73.20
K. \$81.20
33. The plan of the garden will be aligned in the standard (x,y) coordinate plane so that the right angle is at $(0,0)$ and the other 2 vertices are at $(12,0)$ and $(0,-9)$. What coordinates give the location of the water sprinkler?
- A. $(3, -2\frac{1}{4})$
B. $(3, -4\frac{1}{2})$
C. $(4, -3)$
D. $(6, -2\frac{1}{4})$
E. $(6, -4\frac{1}{2})$

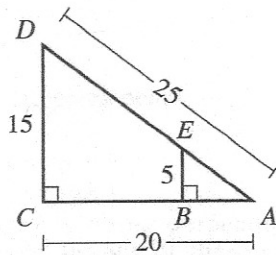
DO YOUR FIGURING HERE.



DO YOUR FIGURING HERE.

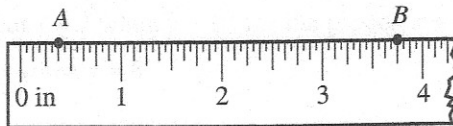
34. The landscaper has decided to enclose the garden by installing a decorative fence of uniform height along the garden's perimeter. What is the minimum length, in feet, of fencing required to enclose the garden?
- F. 15
 G. 21
 H. 30
 J. 33
 K. 36

35. Shown below are right triangles $\triangle ACD$ and $\triangle ABE$ with lengths given in inches. What is the length, in inches, of \overline{AB} ?

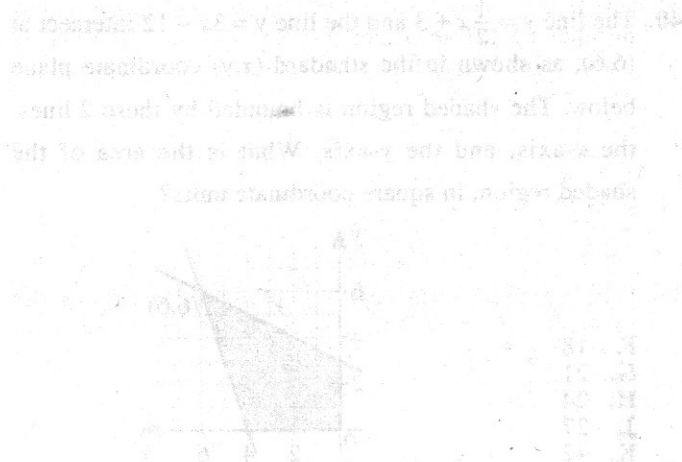
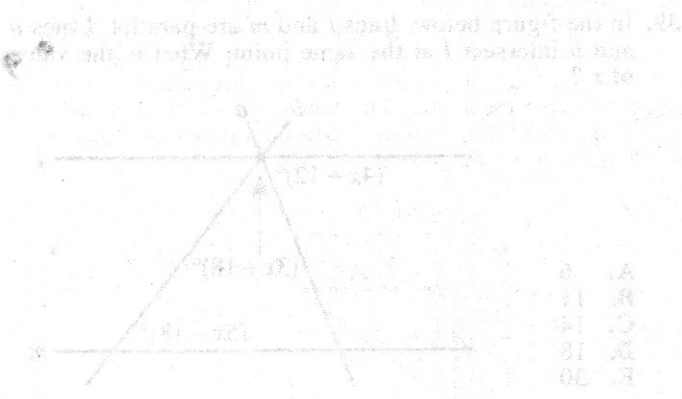


- A. $5\frac{3}{5}$
 B. $5\frac{3}{4}$
 C. $5\frac{4}{5}$
 D. $6\frac{2}{3}$
 E. $8\frac{1}{3}$
36. The circumference of a circle is 50 cm. What is the length, in centimeters, of the diameter of the circle?
- F. $\frac{25}{\pi}$
 G. $\frac{50}{\pi}$
 H. 50
 J. 25π
 K. 50π

37. Which of the following values is closest to the distance, in inches, between point A and point B on the ruler shown below?
 (Note: The ruler shown is NOT actual size.)



- A. $2\frac{1}{8}$
 B. $3\frac{3}{16}$
 C. $3\frac{3}{8}$
 D. $3\frac{9}{16}$
 E. $3\frac{3}{4}$



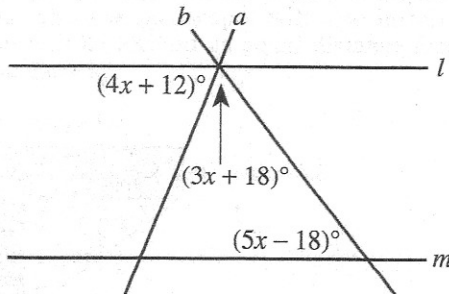


38. If $r + 5 = m$ and $r + 6 = n$, what is the value of $n - m$?

- F. $2r + 1$
- G. $2r + 11$
- H. -1
- J. 1
- K. 11

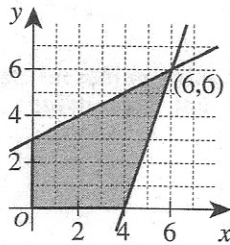
DO YOUR FIGURING HERE.

39. In the figure below, lines l and m are parallel. Lines a and b intersect l at the same point. What is the value of x ?



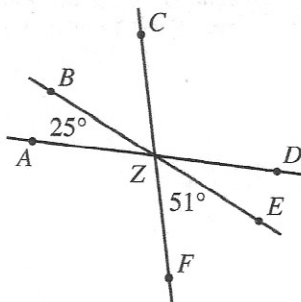
- A. 6
- B. 11
- C. 14
- D. 18
- E. 30

40. The line $y = \frac{1}{2}x + 3$ and the line $y = 3x - 12$ intersect at $(6, 6)$, as shown in the standard (x, y) coordinate plane below. The shaded region is bounded by these 2 lines, the x -axis, and the y -axis. What is the area of the shaded region, in square coordinate units?



- F. 18
- G. 21
- H. 24
- J. 27
- K. 42

41. In the figure below, \overline{AD} , \overline{BE} , and \overline{CF} all intersect at point Z . The measures of 2 angles are given. What is the measure of $\angle CZE$?



- A. 76°
- B. 102°
- C. 104°
- D. 119°
- E. 129°



42. Emma and Kristin each ran 10 laps (4,000 meters) around a 400-meter track without stopping. Emma ran at a constant speed of 250 meters per minute. Kristin ran at a constant speed of 200 meters per minute. Both Emma and Kristin began running at the same instant. How many laps did Kristin have left to run when Emma had completed her run?

F. $\frac{1}{2}$

G. $\frac{4}{5}$

H. $1\frac{1}{4}$

J. 2

K. $2\frac{1}{2}$

43. Three linear equations are given below.

$$\begin{aligned}y &= x \\y &= x + 1 \\y &= -x + 1\end{aligned}$$

In terms of being parallel, being perpendicular, or intersecting, how are the graphs of these equations related in the standard (x,y) coordinate plane?

- A. All 3 lines are parallel.
B. All 3 lines are perpendicular.
C. All 3 lines meet in a common point.
D. Exactly 2 of the lines are parallel.
E. None of the lines are parallel or perpendicular.
44. For what value of a would the following system of equations have an infinite number of solutions?

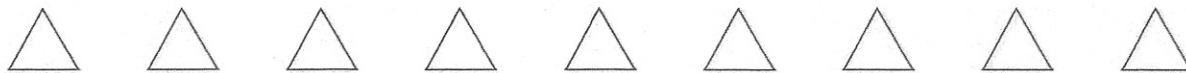
$$\begin{aligned}x - 2y &= 8 \\3x - 6y &= 4a\end{aligned}$$

- F. 2
G. 6
H. 8
J. 24
K. 32

45. Given that $x = 2$ when $y = 12$ for the proportion $\frac{x}{6} = \frac{k}{y}$, what is x when $y = 8$?

- A. $\frac{3}{4}$
B. $\frac{4}{3}$
C. 3
D. 4
E. 12

DO YOUR FIGURING HERE.



46. Two events are *independent* if the outcome of one event does not affect the outcome of the other event. One of the following statements does NOT describe independent events. Which one?

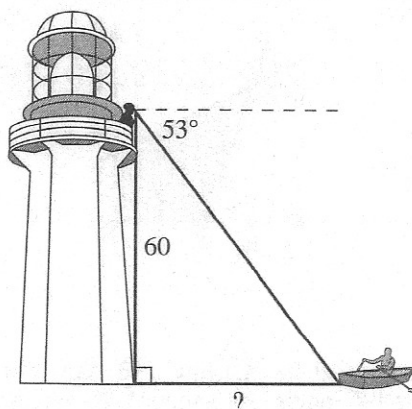
- F. A coin lands heads up, then a single 6-sided die lands with a 3 faceup.
- G. A king is drawn from a deck of cards, then a coin lands heads up.
- H. A 4 is drawn from a deck of cards, then after replacing the card, a 4 is drawn.
- J. A single 6-sided die lands with a 2 faceup, then after being rolled a second time, the die lands with a 1 faceup.
- K. A 7 is drawn from a deck of cards, then without replacing the card, a 2 is drawn.

47. Which of the following binomials is a factor of $3x^2 + 11x - 4$?

- A. $x - 4$
- B. $x - 2$
- C. $x - 1$
- D. $x + 2$
- E. $x + 4$

48. The figure below shows a lighthouse keeper looking down at a rowboat on the sea through a navigational instrument. The instrument is 60 feet above sea level and indicates an angle of depression of 53° to the rowboat. Which of the following is closest to the horizontal distance, in feet, between the navigational instrument and the rowboat?

(Note: $\sin 53^\circ \approx 0.80$, $\cos 53^\circ \approx 0.60$, $\tan 53^\circ \approx 1.33$)



- F. 36
- G. 45
- H. 48
- J. 53
- K. 80

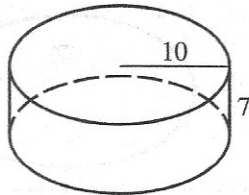
49. Each of 20 students in a class took a test and received a whole number score. The median of the scores was 87. None of the students received a score of 87, and 30% of the students received scores of 90 or above. How many students received scores of 88 or 89?

- A. 3
- B. 4
- C. 5
- D. 6
- E. 10

DO YOUR FIGURING HERE.



50. The radius and height of the right circular cylinder shown below are given in centimeters. Which of the following is closest to the volume, in cubic centimeters, of the cylinder?



- F. 220
G. 310
H. 700
J. 1,540
K. 2,200

51. What value of x satisfies the equation below?

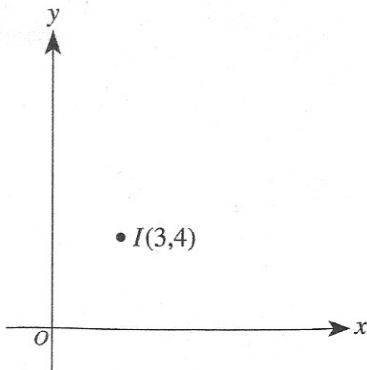
$$\log_{16} x = -\frac{3}{4}$$

- A. -12
B. -8
C. $\frac{1}{12}$
D. $\frac{1}{8}$
E. 8

52. Let x be a negative odd integer. The expression xy^3 is a positive even integer whenever y is any member of which of the following sets?

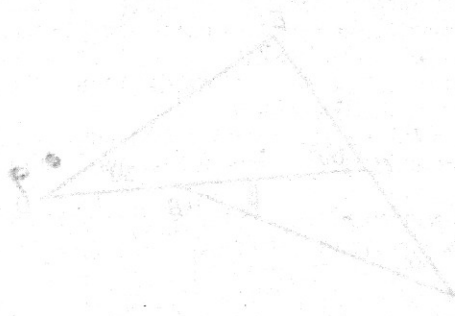
- F. All integers
G. Positive odd integers
H. Positive even integers
J. Negative odd integers
K. Negative even integers

53. Point $I(3,4)$ is shown in the standard (x,y) coordinate plane below. Point I is reflected across the line $x = 7$ and, after the reflection, is labeled J . What are the coordinates of J ?



- A. (-1, 4)
B. (3, 1)
C. (3, 10)
D. (10, 4)
E. (11, 4)

DO YOUR FIGURING HERE.





54. The angle measures of $\triangle CDE$ are shown below. Point B of $\triangle ABC$ lies on \overline{CD} , and point C lies on \overline{AE} . What is the value of $\cos(\alpha + \beta)$?

(Note: $\cos 30^\circ = \frac{\sqrt{3}}{2}$)

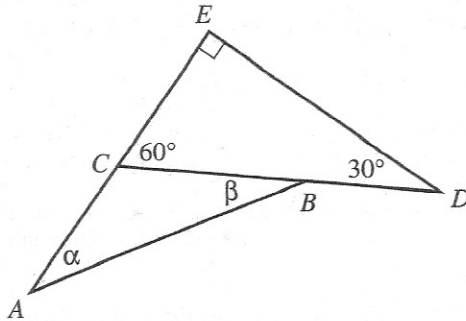
F. 0

G. $\frac{1}{2}$

H. $\frac{\sqrt{2}}{2}$

J. $\frac{\sqrt{3}}{2}$

K. 1



55. The *determinant* of any 2×2 matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is $ad - bc$. The determinant of $\begin{bmatrix} (x+3) & 7 \\ 2 & (x-2) \end{bmatrix}$ is equal to 0. What are all possible values of x ?

A. -5 and 4

B. -4 and 5

C. -3 and 2

D. -1 and 9

E. $-\sqrt{20}$ and $\sqrt{20}$

56. Which of the following inequalities is equivalent to $(|x| + 1)^2 \leq 4$?

F. $-3 \leq x \leq 1$

G. $-3 \leq x \leq 3$

H. $-2 \leq x \leq 2$

J. $-\sqrt{3} \leq x \leq \sqrt{3}$

K. $-1 \leq x \leq 1$

57. Given that $2 \sin a = 2$ and $2 \cos\left(\frac{\pi}{2} - b\right) = 2$, which of the following could be a value, in radians, of $a + b$?

A. 0

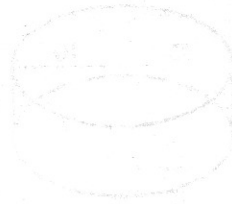
B. $\frac{\pi}{2}$

C. 2

D. π

E. 2π

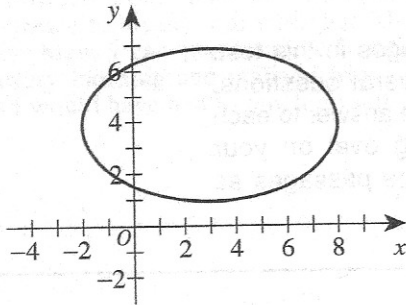
DO YOUR FIGURING HERE.





58. One of the following equations determines the graph in the standard (x,y) coordinate plane below. Which one?

DO YOUR FIGURING HERE.



- F. $\frac{(x-3)^2}{25} + \frac{(y-4)^2}{9} = 1$
 G. $\frac{(x-3)^2}{25} + \frac{(y+4)^2}{9} = 1$
 H. $\frac{(x-3)^2}{9} + \frac{(y-4)^2}{25} = 1$
 J. $\frac{(x+3)^2}{25} + \frac{(y+4)^2}{9} = 1$
 K. $\frac{(x+3)^2}{9} + \frac{(y+4)^2}{25} = 1$

59. Cubes each having a side length of 0.5 cm are put together to form a rectangular solid with 8 layers. Each layer has 6 cubes. What is the volume, in cubic centimeters, of the rectangular solid?

- A. 6
 B. 12
 C. 14
 D. 24
 E. 48
60. Consider the 2 functions $f(x) = 2x + 5$ and $g(x) = 3x + b$, where b is a real number. If $f(g(x)) = g(f(x))$, then $b = ?$

- F. 0
 G. $\frac{10}{3}$
 H. 5
 J. 10
 K. Any real number

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.