



### 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. Harry is paid a regular hourly wage of \$12.50 per hour for working up to and including 40 hours in 1 week. For each additional hour he works in a week, Harry is paid twice his regular hourly wage. Harry worked 46 hours this week. What is his pay for this week?

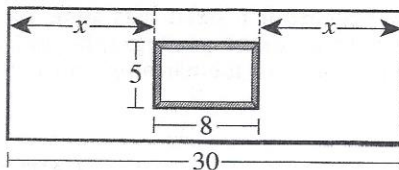
(Note: Amounts are before taxes and benefits are deducted.)

- A. \$ 537.50
- B. \$ 575.00
- C. \$ 650.00
- D. \$ 787.50
- E. \$1,150.00

2. What value of  $x$  makes the equation  $\frac{4(x-6)}{3} = 16$  true?

- F. 4.5
- G. 6
- H. 10
- J. 14.5
- K. 18

3. Ayita is helping her uncle center a large framed picture on his living room wall. As shown in the figure below, the rectangular wall is 30 feet long, and the rectangular framed picture is 5 feet high and 8 feet long. The left edge of the frame will be  $x$  feet from the left edge of the wall, and the right edge of the frame will be  $x$  feet from the right edge of the wall. What is the value of  $x$ ?



- A. 11
- B. 12.5
- C. 15
- D. 22
- E. 25

**DO YOUR FIGURING HERE.**



4. What is the solution to the equation  $3(2x - 1) = 3x + 1$  ?

**DO YOUR FIGURING HERE.**

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

5. For nonzero values of  $x$  and  $y$ , which of the following expressions is equivalent to  $-\frac{24x^4y^3}{4xy}$  ?

- A.  $-6x^3y^2$
- B.  $-6x^4y^3$
- C.  $-6x^5y^4$
- D.  $-20x^3y^2$
- E.  $-28x^3y^2$

6. Tristan has 5 pairs of shoes, 6 pairs of pants, and 5 shirts, which can be worn in any combination. He needs to choose a clothes combination to wear to the school dance. How many different combinations consisting of 1 of his 5 pairs of shoes, 1 of his 6 pairs of pants, and 1 of his 5 shirts are possible for Tristan to wear to the dance?

- F. 11
- G. 16
- H. 30
- J. 60
- K. 150

7. In Arkansas in the twentieth century, the highest recorded temperature was  $120^\circ\text{F}$  and the lowest recorded temperature was  $-29^\circ\text{F}$ . This highest recorded temperature was how many degrees Fahrenheit greater than this lowest recorded temperature?

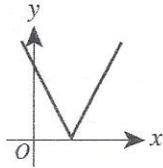
- A.  $75^\circ\text{F}$
- B.  $91^\circ\text{F}$
- C.  $101^\circ\text{F}$
- D.  $109^\circ\text{F}$
- E.  $149^\circ\text{F}$

DO YOUR FIGURING HERE.

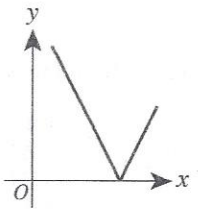
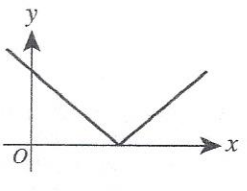
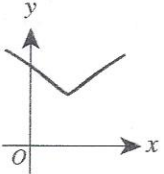
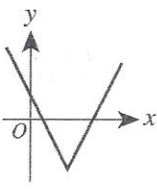
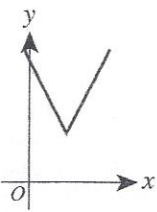
8. A new operation,  $\diamond$ , is defined on pairs of ordered pairs of integers as follows:  $(a,b) \diamond (c,d) = \frac{ac+bd}{ab-cd}$ .  
 What is the value of  $(3,1) \diamond (4,5)$  ?

- F.  $-\frac{17}{11}$
- G.  $-1$
- H.  $\frac{17}{11}$
- J.  $\frac{17}{7}$
- K.  $17$

9. The function  $y = 2|x - 3|$  is graphed in the standard  $(x,y)$  coordinate plane below.



One of the following graphs in the standard  $(x,y)$  coordinate plane shows the result of shifting the function up 4 coordinate units. Which graph?

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

10. What is the least common denominator of the fractions  $\frac{4}{21}$ ,  $\frac{1}{6}$ , and  $\frac{3}{4}$  ?

- F. 28
- G. 84
- H. 126
- J. 168
- K. 504

DO YOUR FIGURING HERE.

11. The average of 5 numbers is 89. What is the 5th number if the first 4 of the numbers are 78, 92, 96, and 94 ?

- A. 85
- B. 86
- C. 87
- D. 90
- E. 94

12. A swimming pool in the shape of a right rectangular prism has length 12 feet and width 14 feet. The volume of water in the pool is 2,520 cubic feet. To the nearest foot, what is the depth of the water in the pool?

- F. 7
- G. 10
- H. 15
- J. 24
- K. 90

13. At Hamburger Heaven, Corissa paid less than \$15 for her order of  $x$  hamburgers and  $x$  bags of french fries. Each hamburger cost  $h$  dollars, and each bag of french fries cost  $f$  dollars. Which of the following expressions represents the amount of money, in dollars, that Corissa should have received back after she paid for her order with \$15 ?

(Note: There is no tax on food at Hamburger Heaven.)

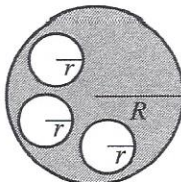
- A.  $xfh$
- B.  $x(f + h)$
- C.  $15 - xfh$
- D.  $15 - x(f + h)$
- E.  $15 - x(f - h)$

14.  $|8(-6) + 3(2)| = ?$

- F. -48
- G. -42
- H. 42
- J. 48
- K. 54

15. A large circle with radius  $R$  inches is shown in the figure below; 3 small nonoverlapping circles, each with radius  $r$  inches, are removed from the large circle. The shaded region is the area of the large circle remaining after the 3 circles were removed. What is the area, in square inches, of the shaded region?

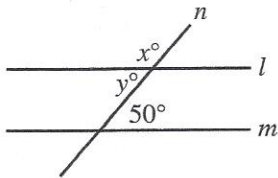
- A.  $\pi r^2$
- B.  $\pi R^2$
- C.  $\pi R^2 - \pi r^2$
- D.  $\pi R^2 - 2\pi r^2$
- E.  $\pi R^2 - 3\pi r^2$



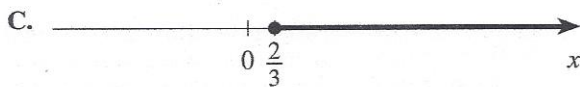
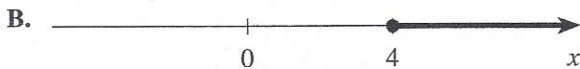
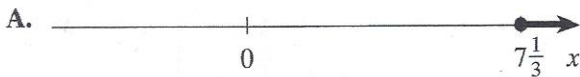


DO YOUR FIGURING HERE.

16. In the figure below, lines  $l$  and  $m$  are parallel, line  $n$  is a transversal, and 3 angle measures are given in degrees. What is the value of  $x - y$ ?



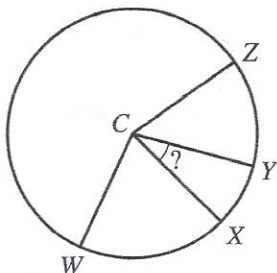
- F. -80  
 G. 50  
 H. 80  
 J. 130  
 K. 180
17. Which of the following graphs shows the solution set for the inequality  $3x - 5 \geq 7$ ?



18. Given the function  $s(t) = 3t^2 - 5$ , what is  $s(-3)$ ?

- F. -42  
 G. -32  
 H. -23  
 J. 12  
 K. 22

19. A circle with center  $C$  is shown below. Points  $W$ ,  $X$ ,  $Y$ , and  $Z$  lie on the circle. The measure of  $\angle WCY$  is  $100^\circ$ , the measure of  $\angle X CZ$  is  $80^\circ$ , and the measure of  $\angle WCZ$  is  $150^\circ$ . What is the measure of  $\angle XCY$ ?



- A.  $20^\circ$   
 B.  $25^\circ$   
 C.  $30^\circ$   
 D.  $40^\circ$   
 E.  $50^\circ$



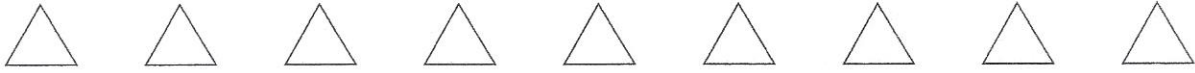
DO YOUR FIGURING HERE.

Use the following information to answer questions 20–22.

The table below shows the number of pounds of sugar, flour, and butter required to make 500 of each of 3 types of cookies sold at Van Mert's Bakery. Let  $s$  represent the price of 1 pound of sugar,  $f$  the price of 1 pound of flour, and  $b$  the price of 1 pound of butter. All prices are in dollars.

Type of cookie	Pounds of sugar	Pounds of flour	Pounds of butter
Snickerdoodle	7	8	5.5
Chocolate chip	6	6.5	5
Oatmeal	5	6	4

20. How many pounds of sugar are required to make 200 chocolate chip cookies?
- F. 2  
G. 2.4  
H. 2.5  
J. 2.8  
K. 3
21. The bakery has 27 pounds of sugar, 24 pounds of flour, and 20 pounds of butter in stock. What is the maximum number of oatmeal cookies the bakery can make from the ingredients in stock?
- A. 2,000  
B. 2,400  
C. 2,500  
D. 2,700  
E. 3,000
22. Which of the following expressions gives the price of the sugar, flour, and butter required to make 500 snickerdoodle cookies and 500 chocolate chip cookies?
- F.  $\frac{13}{s} + \frac{14.5}{f} + \frac{10.5}{b}$   
G.  $\frac{42}{s} + \frac{52}{f} + \frac{27.5}{b}$   
H.  $13s + 14.5f + 10.5b$   
J.  $42s + 52f + 27.5b$   
K.  $42s^2 + 52f^2 + 27.5b^2$



23. In the  $(a,b)$  solution to the system of equations below,  
 $b = ?$

$$\begin{aligned} 5a &= 3 \\ 2a + 3b &= 5 \end{aligned}$$

- A.  $\frac{3}{5}$   
 B.  $\frac{19}{15}$   
 C.  $\frac{25}{21}$   
 D.  $\frac{25}{18}$   
 E. 3
24. Send It Out mails advertisements for businesses. Two types of machines—stuffing machines and postage machines—are used to process envelopes. Each stuffing machine processes envelopes at the rate of 150 envelopes per minute, and each postage machine processes envelopes at the rate of 4 envelopes per second. Send It Out is currently using 24 stuffing machines. How many postage machines should be used so that the stuffing machines and the postage machines process the same number of envelopes in 1 *minute* ?
- F. 6  
 G. 9  
 H. 15  
 J. 25  
 K. 60
25. What is the result of the subtraction problem below?

$$\begin{array}{r} (7x^2 + 5) \\ - (-4x^2 + 6x + 3) \\ \hline ? \end{array}$$

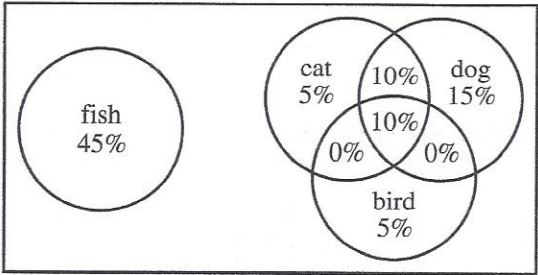
- A.  $3x^2 + 6x + 2$   
 B.  $3x^2 - 6x + 2$   
 C.  $11x^2 + 2$   
 D.  $11x^2 + 6x + 8$   
 E.  $11x^2 - 6x + 2$
26. For what real number value of  $a$  is the equation  $(x^2)^3(x^4)^5 = x^a$  true?
- F. 14  
 G. 15  
 H. 25  
 J. 26  
 K. 45
27. The number 0.003 is 100 times what number?
- A. 0.3  
 B. 0.03  
 C. 0.000 3  
 D. 0.000 03  
 E. 0.000 003

**DO YOUR FIGURING HERE.**

Use the following information to answer questions 28–30.

DO YOUR FIGURING HERE.

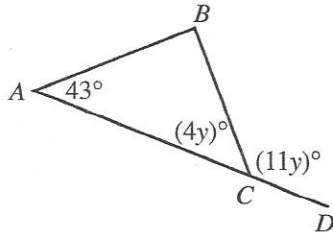
Each of the 200 people in a random sample of the 2,500 people at the mall today was asked which, if any, of the following types of pets he or she owns: bird, cat, dog, or fish. All 200 people answered the question. The answers were tallied, and the exact percents of people who own the pets are shown in the diagram below.



28. Because this was a random sample, the percents in the sample are the most likely estimates for the corresponding percents among all the people at the mall today. What estimate does this give for the number of people at the mall today who own dogs but none of the other 3 types of pets?
- F. 125  
 G. 250  
 H. 375  
 J. 500  
 K. 875
29. What percent of the people in the random sample own exactly 1 type of the 4 types of pets?
- A. 10%  
 B. 25%  
 C. 45%  
 D. 70%  
 E. 90%
30. Suppose 25 additional people at random were asked the question, with the following answers: 15 own fish only, 5 own a cat and a dog only, and 5 own a cat, a dog, and a bird only. Among all 225 people asked, what fraction own fish but none of the other 3 types of pets?
- F.  $\frac{105}{225}$   
 G.  $\frac{105}{215}$   
 H.  $\frac{105}{200}$   
 J.  $\frac{115}{225}$   
 K.  $\frac{115}{200}$



31. Triangle  $\triangle ABC$  and collinear points  $A$ ,  $C$ , and  $D$  are shown in the figure below. The measure of  $\angle A$  is  $43^\circ$ , the measure of  $\angle BCA$  is  $(4y)^\circ$ , and the measure of  $\angle BCD$  is  $(11y)^\circ$ . What is the measure of  $\angle B$ ?

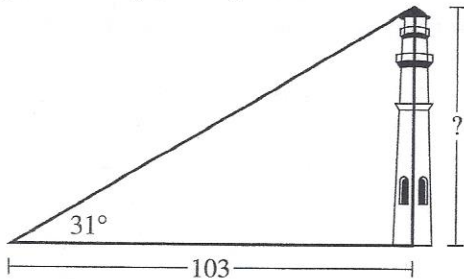


- A.  $12^\circ$
- B.  $48^\circ$
- C.  $89^\circ$
- D.  $91^\circ$
- E.  $132^\circ$

32. In the standard  $(x,y)$  coordinate plane, what are the coordinates of the center of the circle with equation  $(x - \sqrt{5})^2 + (y - 1)^2 = 1$ ?

- F.  $(\sqrt{5}, 1)$
- G.  $(-\sqrt{5}, -1)$
- H.  $(-\sqrt{5}, 1)$
- J.  $(1, \sqrt{5})$
- K.  $(-1, -\sqrt{5})$

33. Anoki wants to determine the height of a vertical lighthouse, shown below. He measures the angle of elevation to the top of the lighthouse at a point 103 feet along level ground from the center of the base of the lighthouse. The angle of elevation is  $31^\circ$ . Which of the following expressions gives the best approximation of the height of the lighthouse, in feet?



- A.  $\frac{\cos 31^\circ}{103}$
- B.  $\frac{\tan 31^\circ}{103}$
- C.  $103 \sin 31^\circ$
- D.  $103 \cos 31^\circ$
- E.  $103 \tan 31^\circ$

34. When graphed in the standard  $(x,y)$  coordinate plane, the graph of one of the following linear equations is a line parallel to the  $x$ -axis. Which one?

- F.  $x = 4$
- G.  $x = 4y$
- H.  $x = y$
- J.  $y = 4$
- K.  $y = 4x$

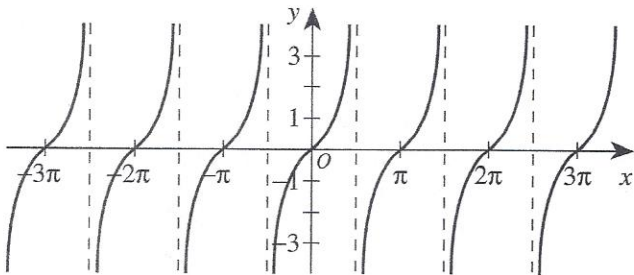
DO YOUR FIGURING HERE.

**DO YOUR FIGURING HERE.**

35. Let  $2x + 3y = 12$  be an equation of line  $l$  in the standard  $(x,y)$  coordinate plane. Line  $p$  has a slope that is 2 times the slope of  $l$  and has a  $y$ -intercept that is 3 less than the  $y$ -intercept of  $l$ . Line  $p$  has which of the following equations?

- A.  $y = -\frac{1}{3}x + 7$
- B.  $y = -\frac{4}{3}x + 1$
- C.  $y = -\frac{4}{3}x + 3$
- D.  $y = -\frac{2}{3}x + \frac{3}{2}$
- E.  $y = -\frac{3}{2}x + \frac{10}{9}$

36. The graph of  $y = \tan x$  is shown in the standard  $(x,y)$  coordinate plane below. What is the period of  $\tan x$ ?



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

37. In a certain rectangle, the ratio of the lengths of 2 adjacent sides is 5 to 2. If the area of the rectangle is 90 square inches, what is the length, in inches, of the longer side?

- A. 6
- B. 9
- C. 15
- D. 18
- E. 45

38. Josey rode her bicycle 4 km at a constant speed, beginning and ending at her home. A graph, with distance traveled plotted along the  $y$ -axis and elapsed time during the ride plotted along the  $x$ -axis, was constructed for the values of  $y$  from 0 km through 4 km. The shape of the graph can best be described as a:

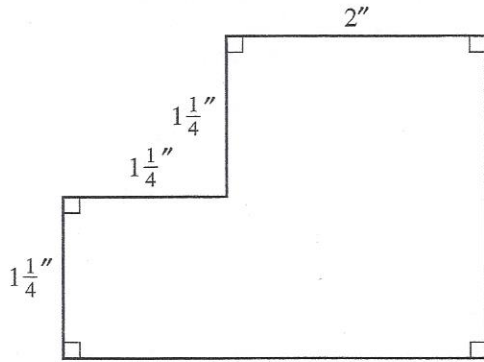
- F. circle.
- G. line segment with a positive slope.
- H. line segment with a negative slope.
- J. horizontal line segment.
- K. vertical line segment.



39. What is the area, in square inches, of the figure below?

DO YOUR FIGURING HERE.

- A.  $4\frac{1}{16}$
- B.  $6\frac{9}{16}$
- C.  $8\frac{1}{8}$
- D.  $9\frac{1}{16}$
- E.  $11\frac{1}{2}$



40. In the standard  $(x,y)$  coordinate plane,  $P(-3,-1)$  will be reflected over the  $y$ -axis. What will be the coordinates of the image of  $P$ ?

- F.  $(-3, 1)$
- G.  $(-1, 3)$
- H.  $(1, -3)$
- J.  $(1, 3)$
- K.  $(3, -1)$

41. One of the following graphs in the standard  $(x,y)$  coordinate plane is the graph of  $y \geq ax + b$  for some positive  $a$  and negative  $b$ . Which graph?

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

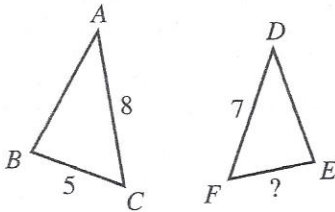


42. If  $\frac{2x-y}{x+y} = \frac{3}{4}$ , then  $\frac{x}{y} = ?$

- F.  $\frac{2}{5}$
- G.  $\frac{3}{4}$
- H.  $\frac{7}{2}$
- J.  $\frac{7}{3}$
- K.  $\frac{7}{5}$

DO YOUR FIGURING HERE.

43. Shown below are similar triangles  $\triangle ABC$  and  $\triangle DEF$  with  $\angle A \cong \angle D$  and  $\angle B \cong \angle E$ . The given lengths are in inches. What is the length, in inches, of  $\overline{EF}$  ?



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

44. A person's *body mass index*, BMI, varies directly as the person's weight in kilograms and inversely as the square of the person's height in meters. If  $k$  represents the constant of variation, which of the following expressions represents the BMI of a person who weighs  $w$  kilograms and is  $h$  meters tall?

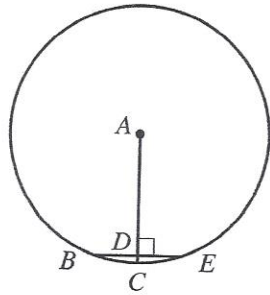
- F.  $\frac{k}{wh^2}$
- G.  $\frac{kw}{h^2}$
- H.  $\frac{kh^2}{w}$
- J.  $\frac{wh^2}{k}$
- K.  $kwh^2$



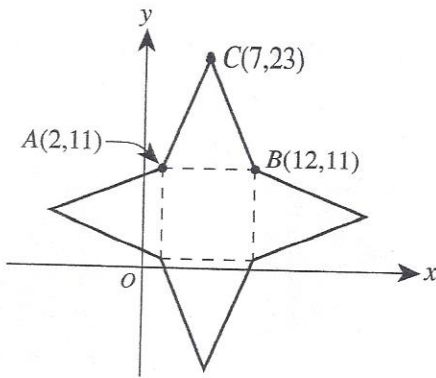
45. In the circle shown below, radius  $\overline{AC}$  is 15 inches long, chord  $\overline{BE}$  is 10 inches long, and  $\overline{AC}$  is perpendicular to  $\overline{BE}$  at  $D$ . How many inches long is  $\overline{AD}$  ?

DO YOUR FIGURING HERE.

- A. 10
- B. 15
- C.  $5\sqrt{5}$
- D.  $5\sqrt{10}$
- E.  $10\sqrt{2}$



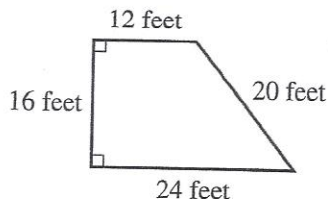
46. A pyramid composed of 4 congruent triangular sides and a square base is shown "unfolded" in the standard  $(x,y)$  coordinate plane below. Points  $A$ ,  $B$ , and  $C$  are vertices of 1 of the triangular sides. What is the total surface area, in square coordinate units, of the pyramid?



- F. 240
- G. 340
- H. 432
- J. 480
- K. 580

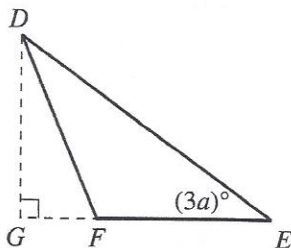
47. The side lengths of the flat, trapezoidal ceiling of a bedroom are given in the figure below. Marie will paint the entire ceiling with 1 coat of paint, using paint that has a price of \$8 per quart and is sold only by the full quart. Each quart of paint covers an area of 90 square feet with 1 coat of paint. What is the total price of the paint that Marie needs to buy?

- A. \$ 8
- B. \$16
- C. \$24
- D. \$32
- E. \$40



48. In the figure below,  $F$  lies on  $\overline{EG}$ , and the measure of  $\angle E$  is  $(3a)^\circ$ . Which of the following inequalities is true?

DO YOUR FIGURING HERE.



- F.  $0 < a < 30$
- G.  $30 < a < 45$
- H.  $45 < a < 60$
- J.  $60 < a < 90$
- K.  $90 < a < 180$

49. Each contestant at a math competition starts with 30 points. A contestant earns 10 points for each question answered correctly and loses 5 points for each question answered incorrectly. Sammi answered twice as many questions correctly as incorrectly, finishing with 150 points. How many questions did Sammi answer correctly?

- A. 8
- B. 12
- C. 16
- D. 20
- E. 24

50. In the standard  $(x,y)$  coordinate plane, when  $a \neq 0$  and  $b \neq 0$ , the graph of  $f(x) = \frac{2x+b}{x+a}$  has a horizontal asymptote at:

- F.  $y = 2$
- G.  $y = a$
- H.  $y = -a$
- J.  $y = -\frac{b}{2}$
- K.  $y = \frac{b}{a}$

51. On the real number line,  $-0.423$  is between  $\frac{n}{100}$  and  $\frac{(n+1)}{100}$  for some integer  $n$ . What is the value of  $n$ ?

- A.  $-423$
- B.  $-43$
- C.  $-42$
- D.  $-5$
- E.  $-4$

52. The stem-and-leaf plot below shows the number of daily credit card sales at Fancy Fabrics during a 34-day period. What is the median number of daily credit card sales?

DO YOUR FIGURING HERE.

Stem	Leaf
3	1 2 2 4 6 8
4	2 2 3 3 5 5 7 8
5	0 0 1 3 5 7 9 9 9
6	0 2 4 4 5 5 6
7	2 6 6 7

Key: 3 | 1 = 31

- F. 52
  - G. 53
  - H. 54
  - J. 55
  - K. 59
53. Angle A has a measure of  $\frac{25}{3}\pi$  radians. Angle A and Angle B are coterminal. Angle B could have which of the following measures?
- A.  $3^\circ$
  - B.  $14^\circ$
  - C.  $26^\circ$
  - D.  $60^\circ$
  - E.  $120^\circ$
54. Which of the following complex numbers equals  $(6 - 7i)(\pi + 6i)$ ?
- F.  $6\pi - 42i$
  - G.  $(6 + \pi) - i$
  - H.  $(6 + \pi) + i$
  - J.  $(6\pi + 42) + (36 - 7\pi)i$
  - K.  $(6\pi - 42) + (36 - 7\pi)i$
55. If  $x = 4$  is one solution to the equation  $x^2 - ax - 12 = 0$ , then the other solution is:
- A. -3
  - B. -2
  - C. -1
  - D. 1
  - E. 3
56. For all  $x$  such that  $\tan x \neq 0$ , the expression  $\frac{\sec^2 x \cdot \sin x}{\tan x}$  is equivalent to which of the following?
- (Note:  $\sec x = \frac{1}{\cos x}$ ;  $\tan x = \frac{\sin x}{\cos x}$ )
- F. 1
  - G.  $\cos x$
  - H.  $\cos^3 x$
  - J.  $\sec x$
  - K.  $\sec x \cdot \tan^2 x$



57. All quadrilaterals in one of the following categories have diagonals that are congruent. Which category?

- A. Parallelogram (each side parallel to opposite side)
- B. Trapezoid (1 pair of parallel sides)
- C. Kite (perpendicular diagonals)
- D. Rhombus (4 congruent sides)
- E. Rectangle (4 right angles)

DO YOUR FIGURING HERE.

58. Three line segments are graphed in the standard  $(x,y)$  coordinate plane below. Line segment  $\overline{AB}$  has endpoints  $A(2,0)$  and  $B(4,0)$ ,  $\overline{A'B'}$  is the image of  $\overline{AB}$  after a rotation counterclockwise ( $\curvearrowright$ ) by  $120^\circ$  about the origin, and  $\overline{A''B''}$  is  $\overline{A'B'}$  projected onto the  $x$ -axis. What is the length, in coordinate units, of  $\overline{A''B''}$ ?

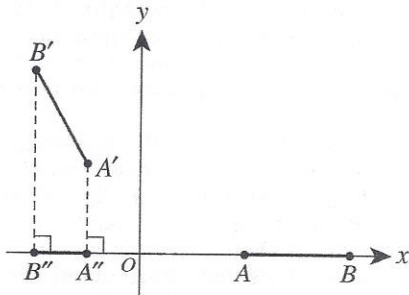
F. 1

G.  $\sqrt{2}$

H.  $\sqrt{3}$

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

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



59. Consecutive terms of a certain arithmetic sequence have a positive common difference. The sum of the first 3 terms of the sequence is 120. Which of the following values CANNOT be the first term of the arithmetic sequence?

- A. 20
- B. 24
- C. 30
- D. 39
- E. 44

60. Given  $f(x) = \sqrt[3]{x+2}$ , which of the following expressions is equal to  $f^{-1}(x)$  for all real numbers  $x$ ?

- F.  $x^3 - 2$
- G.  $(x-2)^3$
- H.  $-\sqrt[3]{x+2}$
- J.  $\sqrt[3]{x-2}$
- K.  $\sqrt[3]{x} - 2$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.