## MATHEMATICS TEST

*60 Minutes—60 Questions*

**Directions:** Solve each of the following problems, select the correct answer, and then fill in the corresponding space on your answer sheet.

Don't linger over problems that are too time-consuming. Do as many as you can, then come back to the others in the time you have remaining.

The use of a calculator is permitted on this test. Though you are allowed to use your calculator to solve any questions you choose, some of the questions may be most easily answered without the use of a calculator.

Note: Unless otherwise noted, all of the following should be assumed.

1. Illustrative figures are *not* necessarily drawn to scale.
2. All geometric figures lie in a plane.
3. The term *line* indicates a straight line.
4. The term *average* indicates arithmetic mean.

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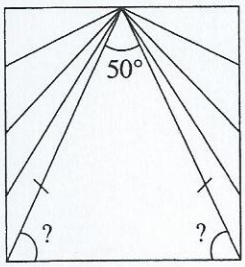
**DO YOUR FIGURING HERE.**

1. The local newspaper has 3 sales offices. Every day, the sales people assigned to each of these offices sell an average of 450, 670, and 830 newspapers, respectively. If all 3 offices sell newspapers at the same time each day, how many days will it take to reach the total sales goal of 17,550 newspapers?

   **A.** $3\frac{1}{3}$
   **B.** 9
   **C.** 18
   **D.** 27
   **E.** 54

2. The isosceles triangle in the quilt square below has one angle that measures 50°. What is the measure of each of the other two angles in the triangle?

   **F.** 25°
   **G.** 50°
   **H.** 65°
   **J.** 75°
   **K.** 130°




3. The expression $5y^4 \cdot 6y^2$ is equal to which of the following?

   **A.** $11y^2$
   **B.** $11y^6$
   **C.** $11y^8$
   **D.** $30y^6$
   **E.** $30y^8$

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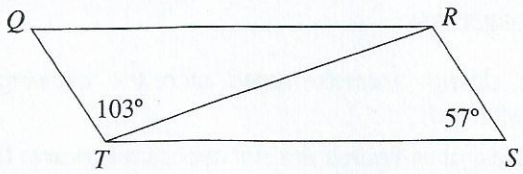
**DO YOUR FIGURING HERE.**

4. Parallelogram $QRST$ is shown below. What is $\angle SRT$?




F. 20°
G. 57°
H. 73°
J. 103°
K. 160°

5. If $x = 40$, what is the value of $\frac{10,000}{1,000 + 100x} + 10$?

A. 2
B. 10
C. 12
D. 30
E. 52

6. Which of the following numbers has the smallest value?

F. $2.31 \times 10^5$
G. $231 \times 10^{-6}$
H. $0.231 \times 10^{-2}$
J. 0.0000231
K. $0.0231 \times 10^{-4}$

7. Ella has 18 pens in a bag—6 with blue ink, 9 with black ink, and 3 with green ink. If Ella randomly chooses a pen from the bag, what is the probability that her pen will NOT have green ink?

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

8. A baker uses one large container of flour each day. He uses $\frac{1}{4}$ of the total amount of flour to make 12 loaves of bread. If the baker uses an average of 3 cups of flour per loaf of bread, how many cups of flour are in the large container?

F. 12
G. 36
H. 48
J. 144
K. 180

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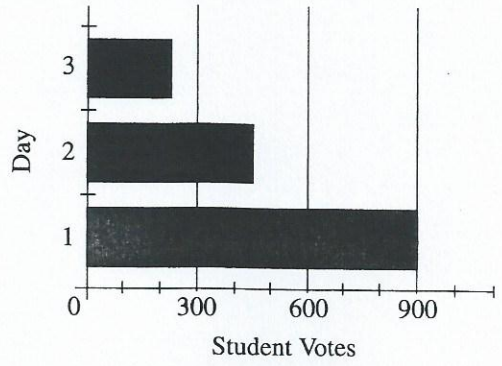
**Use the information below to complete questions 9–11.**

DO YOUR FIGURING HERE.

The Northeastern High School held a vote to determine the new president of the student council. The school held the vote over 3 days. A total of 1,595 students voted in those 3 days. The number of student votes per day is shown in the bar graph below.




9. Approximately what is the mean number of student votes per day collected over the 3-day voting period?

   **A.** 300 student votes
   **B.** 460 student votes
   **C.** 530 student votes
   **D.** 670 student votes
   **E.** 900 student votes

10. Approximately what fraction of the total student votes that were collected over the 3-day period were collected on Day 2?

   **F.** $\frac{1}{30}$
   **G.** $\frac{1}{10}$
   **H.** $\frac{3}{20}$
   **J.** $\frac{1}{5}$
   **K.** $\frac{3}{10}$

11. The school principal planned to extend the vote to a fourth day. She determined a geometric sequence that approximates the number of votes collected on each of the 3 days that votes were collected. According to the principal's sequence, about how many votes would be collected on Day 4 ?

   **A.** 0
   **B.** 50
   **C.** 110
   **D.** 150
   **E.** 200

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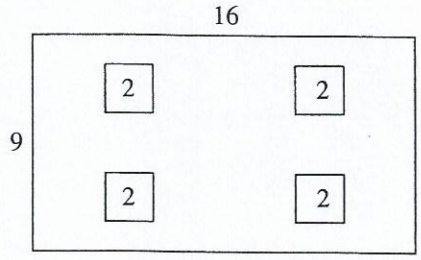
**DO YOUR FIGURING HERE.**

**12.** A rectangular field has four square patches of wildflowers; the rest of the field is grass. The field is 16 meters long and 9 meters wide, and the patches of wildflowers are 2 meters on each side, as shown below. What is the area, in square meters, of the region covered by grass?

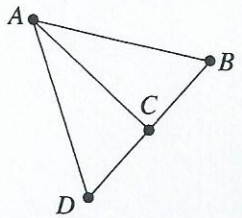
**F.** 128
**G.** 136
**H.** 140
**J.** 144
**K.** 16




**13.** In the figure below, point $C$ is on line segment $BD$. How many different triangles can you form using only the points below as vertices?

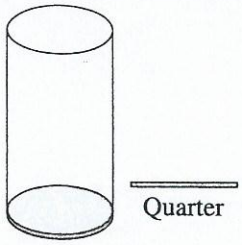
(Note: $\Delta ABC$, $\Delta BAC$, $\Delta CAB$, etc., are the same triangle)

**A.** 1
**B.** 2
**C.** 3
**D.** 12
**E.** 14




**14.** Sedric has a container to hold quarters. The container is shaped like a cylinder, and each quarter has a thickness of 1.75 mm and a diameter of 24.26 mm. If the container is 70 mm tall, what is the maximum number of quarters that can fit in the container?

**F.** 14
**G.** 24
**H.** 40
**J.** 70
**K.** 84




Container

**15.** 33 is what percent of 275 ?

**A.** 120%
**B.** 12%
**C.** 8.3%
**D.** 0.83%
**E.** 0.12%

**16.** Which expression is equivalent to $(3x - 2)(5x + 1)$ ?

**F.** $8x^2 - 1$
**G.** $8x^2 + 5x - 1$
**H.** $15x^2 - 2$
**J.** $15x^2 + 13x - 2$
**K.** $15x^2 - 7x - 2$

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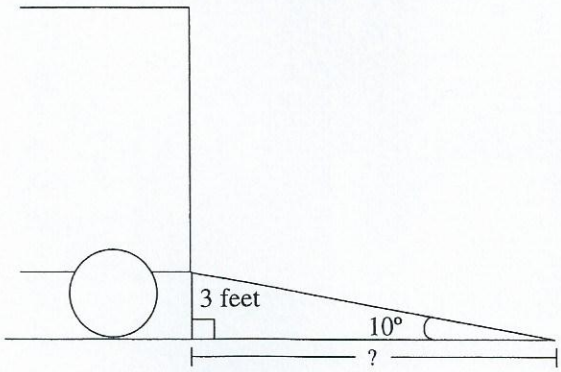
**DO YOUR FIGURING HERE.**

17. What is the value of the function $f(x) = -x^2 + 6x$ when $x = -2$?

A. $-16$
B. $-8$
C. $-2$
D. 8
E. 16

18. A moving company needs a new ramp to load boxes into a truck. The loading area of the truck is 3 feet above the ground, and they want the ramp to have a 10° angle, as shown below. At what distance from the truck will the ramp meet the ground?

(Note: $\cos 10° = \sin 80° \approx 0.98$
$\cos 80° = \sin 10° \approx 0.17$
$\tan 10° \approx 0.18$
$\tan 80° \approx 5.67$)




F. 0.5 feet
G. 3.0 feet
H. 1.9 feet
J. 10.2 feet
K. 16.7 feet

19. On a real number line, point $S$ is at $-4$ and point $T$ is at 6. Which coordinate represents the midpoint of $\overline{ST}$?

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

20. A museum recently acquired a new statue for its collection. Museum security wants to mark a shape on the floor to keep visitors of the museum a minimum of 5 feet away from the statue in all directions. Which of the following shapes would allow visitors to stand 5 feet away from the statue in all directions?

F. A circle with a radius of 5 feet
G. A square with 5 foot sides
H. A triangle with 5 foot sides
J. A circle with a diameter of 5 feet
K. A pair of parallel lines, each 5 feet from the statue

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DO YOUR FIGURING HERE.

21. $\dfrac{8+\frac{1}{3}}{2+\frac{1}{9}}$ is equivalent to:

A. 2
B. 3
C. $\frac{75}{19}$
D. 4
E. $\frac{475}{3}$

22. If $x = 8$, what is the value of $\sqrt{x+x}$?

F. 2
G. 4
H. 8
J. 16
K. 64

23. What is the value of $y$ that makes $3(y+4)+5y=4(y-3)-6$?

A. $-\frac{13}{4}$
B. $-\frac{15}{2}$
C. $-\frac{9}{2}$
D. 6
E. $-\frac{15}{2}$

24. The least common multiple of 60, 50, and 70 is:

F. 60
G. 180
H. 210
J. 2,100
K. 210,000

25. A bike shop charges \$15 to rent a bicycle for 2 hours or less. Any rental that extends longer than 2 hours costs \$7.50 per hour. Which expression represents the total cost of a bike rental that lasts longer than 2 hours, if $t$ represents the length of the rental in hours?

A. 15
B. $7.5t$
C. $7.5t - 15$
D. $15t + 7.5$
E. $15t$

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**DO YOUR FIGURING HERE.**

**26.** Which expression is equivalent to $d$ in the equation $f = ac - bd$? (Assume none of the variables are equal to zero.)

**F.** $\frac{ac - f}{b}$

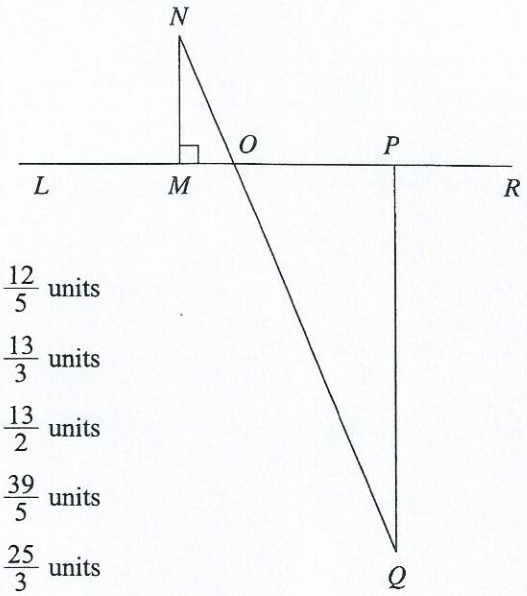
**G.** $-\left(\frac{f}{b}\right) - ac$

**H.** $\frac{f}{ac - b}$

**J.** $f - ac + b$

**K.** $\frac{f - ac}{b}$

**27.** In the figure below, points $L$, $M$, $O$, $P$, and $R$ lie on the same line. $\overline{NM}$ is perpendicular to $\overline{LR}$, and $\overline{PQ}$ is perpendicular to $\overline{LR}$. $\overline{PQ}$ has a length of 12 units, $\overline{OP}$ has a length of 5 units, and $\overline{MN}$ has a length of 4 units. What is the length of $\overline{NO}$?




**A.** $\frac{12}{5}$ units

**B.** $\frac{13}{3}$ units

**C.** $\frac{13}{2}$ units

**D.** $\frac{39}{5}$ units

**E.** $\frac{25}{3}$ units

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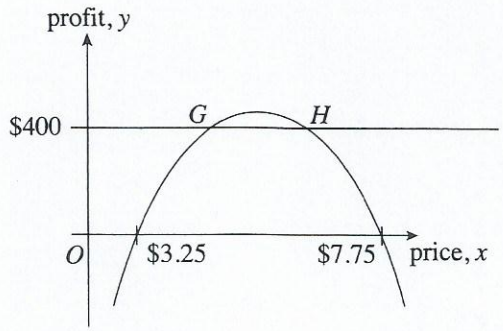
**28.** A basketball team made breakfast for the school community as a fundraiser. The team president used a parabolic function to predict the amount of profit the team would make depending on what price they charged for breakfast. The prices at which profit would be \$0 are \$3.25 and \$7.75. Which statement, according to the model, is true?




**F.** There are not any prices at which the team will lose money.
**G.** The maximum profit occurs when the ticket price is approximately \$5.50.
**H.** A ticket price of \$3.25 yields a profit of \$400.
**J.** The maximum profit occurs when the ticket price is \$7.75.
**K.** Points $G$ and $H$ represent the points at which the team will make the maximum profit.

**29.** Which expression is equivalent to $\frac{x+2}{x^2+7x+10}$ when the expression is defined?

**A.** $\frac{2}{7}$
**B.** $\frac{1}{x+2}$
**C.** $\frac{1}{x+5}$
**D.** $\frac{2}{x+7}$
**E.** $\frac{2}{x^2+7}$

**30.** Line $s$ intersects plane $p$ at point $Q$. How many other lines intersect plane $p$ at point $Q$?

**F.** 0
**G.** 1
**H.** 2
**J.** 3
**K.** Infinitely many

**DO YOUR FIGURING HERE.**

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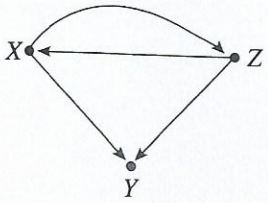
**DO YOUR FIGURING HERE.**

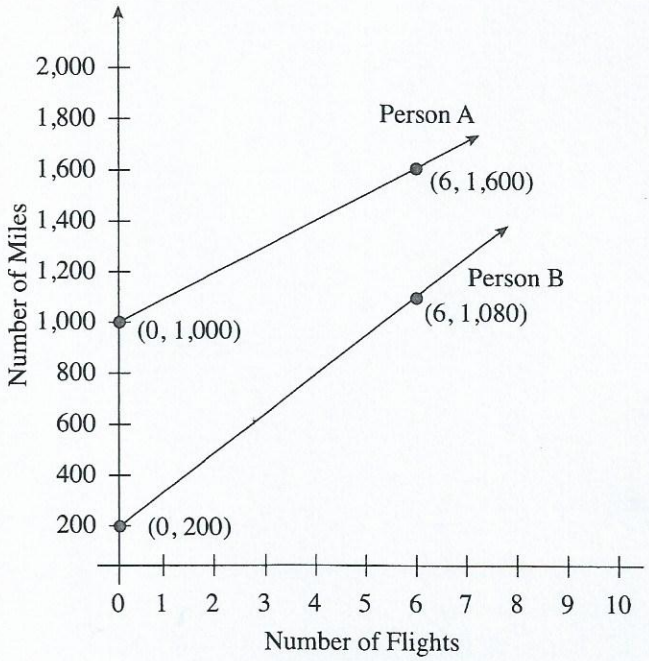
31. The diagram and matrix below show how three train stations are connected to each other. For example, the arrows in the diagram show that there is a train that goes from station $X$ to station $Y$, but no train that goes from station $Y$ to station $Z$. In the matrix, a 1 means that there is a train that connects the two stations, and a 0 means that there is no train that connects the two stations. Which of these is the second row of the matrix?




| | X | Y | Z |
|---|---|---|---|
| X | 0 | 1 | 1 |
| Y | | | |
| Z | 1 | 1 | 0 |

**A.** 1 1 1
**B.** 0 0 0
**C.** 0 0 1
**D.** 1 0 0
**E.** 1 0 1

32. The graph below shows the number of frequent flyer miles two friends have earned with two different plans from the same airline. How many miles have they earned in all after they each take 3 flights?




**F.** 340
**G.** 400
**H.** 1,300
**J.** 1,940
**K.** 2,700

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DO YOUR FIGURING HERE.

33. What is the value of $(3 - i)^2$?

A. 8
B. 10
C. $8 - 6i$
D. $10 - 6i$
E. $-6i$

34. For what values of $t$ is $\frac{t+4}{t(t-5)}$ undefined?

F. 0 and 5
G. 0 only
H. $-4$ and 0
J. $-4$ and 5
K. $-4$, 0, and 5

35. At a certain university, 1 out of every 7 college students majors in education. If there are 3,500 education majors, how many total students attend the university?

A. 500
B. 2,100
C. 21,000
D. 24,500
E. 28,000

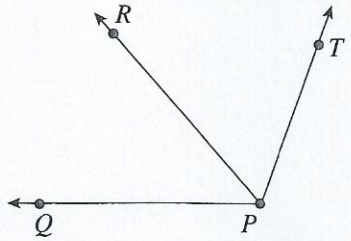
36. The Riverview Lodge charges the following for renting a canoe:

| Number of hours | Total Cost |
|---|---|
| 2 | $41 |
| 4 | $57 |
| 6 | $73 |
| 8 | $89 |

If $C$ represents the total cost in dollars and $H$ represents the number of hours the canoe is rented, which of the following equations best fits the information in the table above?

F. $C = 16H$
G. $C = 16H - 89$
H. $C = 8H$
J. $C = 8H + 25$
K. $C = H + 41$

37. In the figure below, the measure of $\angle QPT$ is 110°. If the measure of $\angle RPT$ is $(y + 15)°$, what is the measure of $\angle QPR$?




A. $(y - 95)°$
B. $(95 - y)°$
C. $(95 + y)°$
D. $(125 - y)°$
E. $(125 + y)°$



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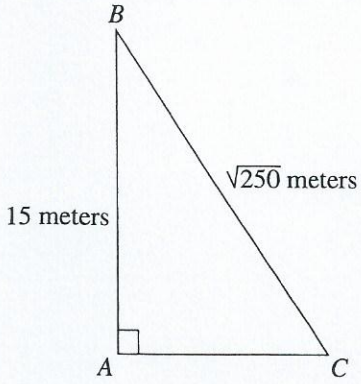
**DO YOUR FIGURING HERE.**

**38.** Milan is drawing a design for a wall mural that has a pattern of flowers. One flower is on the top row, and each row below has one more flower than the row above it. How many flowers are needed to make 60 rows?

**F.** 120
**G.** 240
**H.** 600
**J.** 1,830
**K.** 3,600

**39.** What is the value of sin $C$ in right triangle $\Delta ABC$ below?

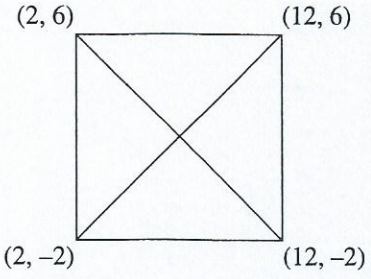
**A.** $\frac{10}{\sqrt{250}}$
**B.** $\frac{10}{15}$
**C.** $\frac{15}{\sqrt{250}}$
**D.** $\frac{15}{10}$
**E.** $\frac{\sqrt{250}}{10}$




**40.** The rectangular soccer field at Recreation Park is twice as long as it is wide. The perimeter of the field is 300 yards. What is the length, in yards, of the soccer field?

**F.** 50
**G.** 75
**H.** 100
**J.** 150
**K.** 300

**41.** The diagonals of a rectangle connect the opposite corners of the rectangle. The vertices of the rectangle are located at the points (2, 6), (12, 6), (12, −2), and (2, −2). What are the coordinates of the point where they meet?




**A.** (7, 2)
**B.** (8, 4)
**C.** (10, 8)
**D.** (14, 4)
**E.** Cannot be determined

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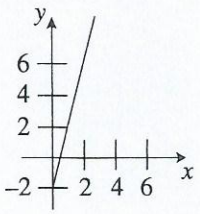
**DO YOUR FIGURING HERE.**

**42.** What is the value of the expression $\frac{(-rt^3 + 2s)}{(s^2)}$ when $r = 3, s = \frac{1}{2}$, and $t = -1$ ?

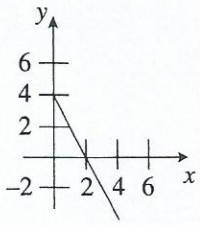
**F.** 10
**G.** 16
**H.** 28
**J.** 40
**K.** 112

**43.** Which of the following is the graph of the equation $y + 2 = 4x$?

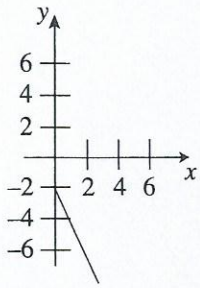
**A.**



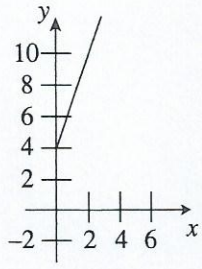

**B.**



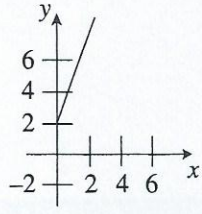

**C.**




**D.**




**E.**

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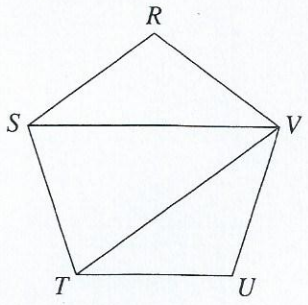
DO YOUR FIGURING HERE.

**44.** The figure below shows diagonals drawn on regular pentagon $RSTUV$. What is the measure of $\angle RVT$?




**F.** 36°
**G.** 72°
**H.** 90°
**J.** 108°
**K.** 144°

**45.** A rectangle has a width that is 4 feet less than the length. If the area of the rectangle is 60 square feet, how many feet is the width?

**A.** 6
**B.** 10
**C.** $16\frac{1}{2}$
**D.** 20
**E.** $\sqrt{20} - 4$

**46.** What is the solution set of the system of equations below?

$$x + 3y = 11$$
$$6x - 3y = 3$$

**F.** (3, 0)
**G.** (2, 3)
**H.** (3, 2)
**J.** (−2, 3)
**K.** (0, −2)

**47.** For all real numbers $x$ and $y$ such that $|xy| = xy$, which of the following must be FALSE?

**A.** $y = -x$
**B.** $y = (\sqrt{y})^2$
**C.** $-x = -\sqrt{y^2}$
**D.** $-x = -y$
**E.** $x = y$

**48.** A set of integers is each increased by 4 and then multiplied by 3. The mean of the resulting set of numbers is $m$. Which of the following expressions represents the mean, in terms of $m$, of the original set of numbers?

**F.** $\frac{1}{3}m - 4$
**G.** $m - 4$
**H.** $m$
**J.** $m + 4$
**K.** $3m + 4$



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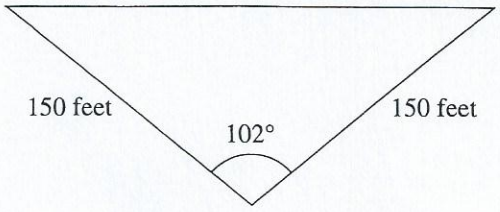
**49.** A house is being built on a piece of property that is in the shape of a triangle. Two sides of the plot are 150 feet long, and they meet at an angle of 102°. Which of the following expressions gives the number of feet of fencing needed for the perimeter of the property?

(Note: The law of sines states that the ratios between the length of the side opposite any angle and the sine of that angle are equal for all interior angles in the same triangle.)




**A.** $150 + 2\left(\frac{150 \sin 102°}{\sin 39°}\right)$

**B.** $2(150) + \frac{150 \sin 102°}{\sin 39°}$

**C.** $2(150) + 150 \sin 102°$

**D.** $2(150) + \frac{150 \sin 139°}{\sin 102°}$

**E.** $3\left(\frac{150 \sin 102°}{\sin 39°}\right)$

**50.** If the equation of line $m$ is $y = -5x + 1$, which equation represents a line that is perpendicular to $m$?

**F.** $y = 5x - 1$

**G.** $y = 0.5x + 25$

**H.** $y = -\frac{1}{5}x - 10$

**J.** $y = -\frac{2}{5}x - 8$

**K.** $y = \frac{1}{5}x - 10$

**51.** Which of the following is an equation of a circle in the standard $(x,y)$ coordinate plane that has a diameter of 12 and the same center as the circle $x^2 + 4x + 4 + y^2 = 16$?

**A.** $x^2 + y^2 = 36$
**B.** $x^2 + (y + 2)^2 = 36$
**C.** $x^2 + (y - 2)^2 = 36$
**D.** $(x - 2)^2 + y^2 = 36$
**E.** $(x + 2)^2 + y^2 = 36$

**DO YOUR FIGURING HERE.**

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**DO YOUR FIGURING HERE.**

**52.** The equation of line $p$ is $3x - 5y = 6$. What is the slope of a line that is parallel to line $p$?

**F.** $-\frac{6}{5}$

**G.** $-\frac{5}{3}$

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

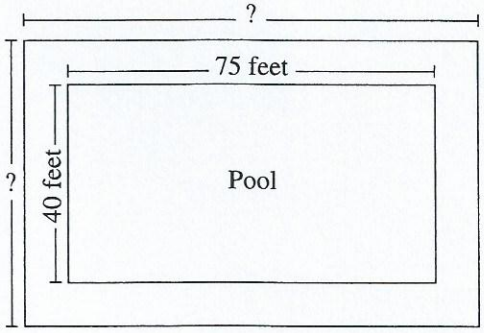
**J.** $\frac{3}{5}$

**K.** $\frac{5}{3}$

**53.** Let $q$, $r$, $s$, $t$, and $x$ be positive real numbers. What is the minimum value of the trigonometric function $f(x) = q[r \sin s(x - t)]$?

**A.** $-qr$
**B.** $-q$
**C.** 0
**D.** $qr$
**E.** $r - t$

**54.** An architect is drawing the design for a swimming pool at the local recreation center. The pool is going to be 75 feet long and 40 feet wide. If the architect wants $8\frac{5}{6}$ feet of space between the edge of the pool and the wall as shown in the diagram, what are the minimum dimensions of the pool area?




**F.** $57\frac{1}{3}$ feet by $22\frac{1}{3}$ feet

**G.** $66\frac{1}{6}$ feet by $31\frac{5}{6}$ feet

**H.** $82\frac{2}{3}$ feet by $47\frac{1}{3}$ feet

**J.** $83\frac{5}{6}$ feet by $48\frac{5}{6}$ feet

**K.** $92\frac{2}{3}$ feet by $57\frac{2}{3}$ feet

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DO YOUR FIGURING HERE.

55. The length and width of a rectangular prism are both doubled while the height remains the same. This creates a new larger cube. How many times larger is the volume of the new rectangular prism compared to the smaller, original prism?

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

56. A painting crew can paint 4 rooms in 7 hours. If the crew works at this rate, how many rooms could the crew paint in $7 + h$ hours?

F. $\frac{4}{7h} + 7$

G. $\frac{4}{7} + h$

H. $\frac{7}{4h} + 7$

J. $4 + \frac{7h}{4}$

K. $4 + \frac{4h}{7}$

57. What is the distance, in units, between point $A$ located at $(6, 3)$ on a coordinate grid and point $B$ located at $(-1, -4)$ on a coordinate grid?

A. $2\sqrt{2}$
B. $2\sqrt{7}$
C. $7\sqrt{2}$
D. $14\sqrt{2}$
E. $14\sqrt{7}$

58. If $\frac{1}{y} < \frac{1}{z} < \frac{1}{w}$ is true for all positive integers $w$, $y$, and $z$, which statement below must be true?

F. $y < w < z$
G. $y < z < w$
H. $w < y < z$
J. $w < z < y$
K. $z < w < y$

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**59.** For the values of $a$ and $b$ where $a + b$ is at most 5, $a$ is at least 3, and $b$ is at least $-2$, what is the minimum value of $b - 3a$?

**A.** $-23$
**B.** $-21$
**C.** $-19$
**D.** 7
**E.** 13

**60.** The graphs of the equations below are parallel lines, and $c$, $d$, $e$, $m$, and $n$ are real numbers.

$$y = \frac{d}{c}x + e$$

$$y = \frac{m}{n}x + e$$

Which of these statements must be true?

**F.** $c = n$ and $d \neq m$
**G.** $d = m$ or $d \neq m$
**H.** $d = c$ and $m = n$
**J.** $\frac{d}{c} = \frac{n}{m}$
**K.** $\frac{d}{c} = \frac{m}{n}$

**DO YOUR FIGURING HERE.**

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