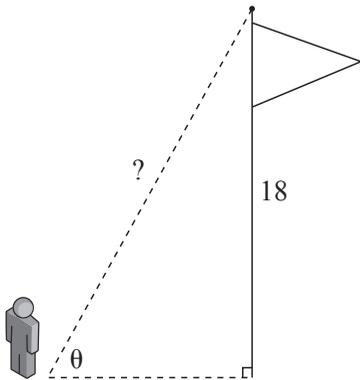# DRILL 1—GEOMETRY

28. Mario is standing on the ground and looking at the top of a flagpole. He knows that the flagpole is exactly 18 feet high and that $\sin\theta = \dfrac{5}{13}$, where θ is the angle indicated in the figure below. About how many feet long is the indicated distance from the top of the flagpole to where Mario is standing?

**F.** 46.8
G. 43.2
H. 19.5
J. 13.0
K. 6.9

37. Triangle *XYZ* below has an area of 72 square inches. Circle *O* is tangent to the triangle at *W*, and the height of the triangle is equal in length to the base. If the line *WY* is a diameter of circle *O*, what is the area, in square inches, of the circle?

A. 6π
B. 12π
C. 24π
D. 36π
E. 144π
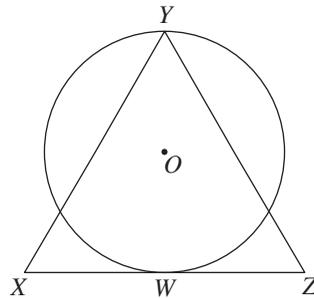
Use the following information to answer questions 39–40.

Shown below is a rectangular pool with a ramp leading up to one side. A water pump fills the pool at an average rate of 70 cubic yards per hour. The pool is a rectangular box with a length of 20 yards, a width of 10 yards, and a height of 3 yards. Also shown below is a ramp that leads to the top of the pool. The ramp is attached to the top of the pool and has an angle of elevation of 48°.
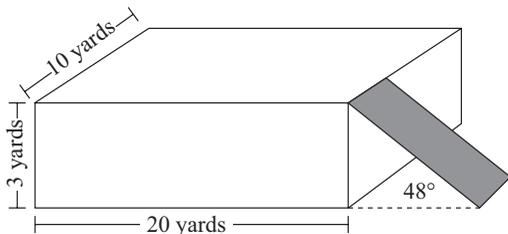

39. The water pump starts to fill a completely empty pool and continues until the pool is completely filled. To the nearest 0.1 hours, for how many hours does the pump fill the pool with water?

- **A.** 8.5
- **B.** 8.6
- **C.** 14.3
- **D.** 103.0
- **E.** 114.3

40. Rosie wants to build a pool that is geometrically similar to the pool shown in the figure. The new pool will have a height of $4\frac{1}{2}$ yards. What will be the length, in yards, of the longest side of the new pool?

- **F.** 10
- **G.** $13\frac{1}{3}$
- **H.** 15
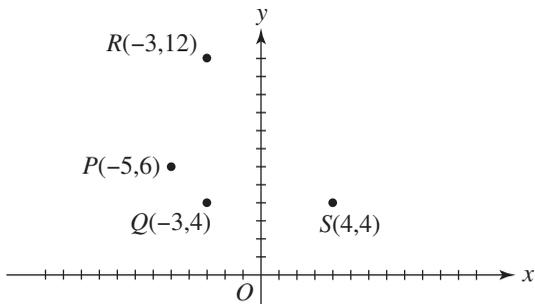- **J.** $21\frac{1}{2}$
- **K.** 30

41. Triangle *ABC* shown below is isosceles, and line segment *DE* is parallel to *AC*. What is the perimeter, in inches, of the quadrilateral *ADEC* ?
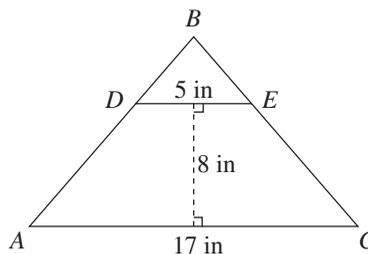
- **A.** 20
- **B.** 22
- **C.** 30
- **D.** 38
- **E.** 42

Use the following information to answer questions 44–45.

The points $P(-5,6)$, $Q(-3,4)$, $R(-3,12)$, and $S(4,4)$ are shown in the standard (x,y) coordinate plane below.


44. What is the slope of $\overleftrightarrow{PR}$?

   F.   3

   G. $-\dfrac{2}{9}$

   H. -1

   J. $-\dfrac{9}{4}$

   K. -4

45. What is the tangent of the smallest angle in right triangle QRS ?

   A. $\dfrac{7}{15}$

   B. $\dfrac{7}{\sqrt{105}}$

   C. $\dfrac{8}{\sqrt{105}}$

   D. $\dfrac{7}{8}$

   E. $\dfrac{8}{7}$

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48. Tommy lives on the edge of a lake and wants to travel by boat to his friend Sherrie's house. Tommy travels the 550 yards from his house to Sherrie's house along a straight line in a direction (shown below) that is 33° clockwise from due east. To the nearest yard, Sherrie's house is how many yards due south and how many yards due east from Tommy's house?

(Note: $\sin 33° \approx 0.545$, $\cos 33° \approx 0.839$)
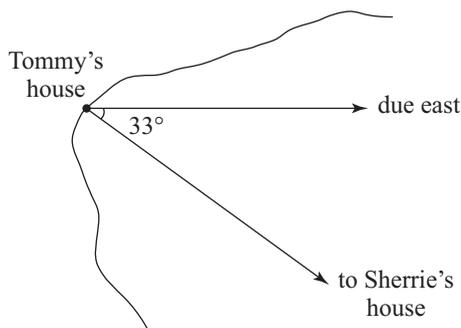
	Due south	Due east
F.	275	476
G.	300	461
H.	325	550
J.	389	389
K.	461	300

50. In the figure below, a table in the shape of an equilateral triangle is placed on top of 3 circular stands. The length of each side of the table is 20 inches. The stands are congruent, and each stand is tangent to the other 2 stands. Each vertex of the table lies on the center of a circle. The region that is interior to the table and exterior to all 3 stands is shaded. What is the area, to the nearest square inch, of the shaded region?
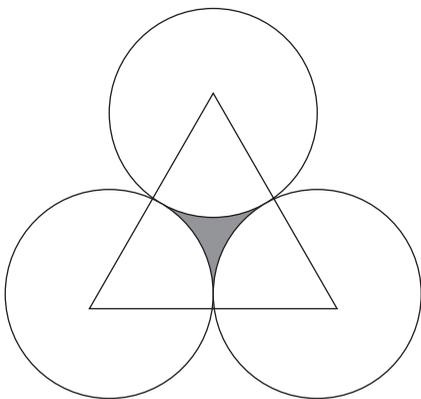
- **F.**   16
- **G.**   52
- **H.**   121
- **J.**   157
- **K.**   173

59. Which of the following equations describes a line that is parallel to a line with equation $-4x + 3y = 24$?

- **A.** $-8x + 6y = 36$
- **B.** $-4x - 3y = 12$
- **C.** $-3x + 4y = 18$
- **D.** $4x + 3y = 9$
- **E.** $8x + 6y = 21$

DRILL 2—PLUGGING IN

32. In a set of 5 numbers, value *A* is removed and replaced with a different number, value *B*. If the mean of the new set is 2 more than the mean of the original set, what is the positive difference between *A* and *B* ?

- **F.** $\dfrac{2}{5}$
- **G.** 3
- **H.** 7
- **J.** 10
- **K.** 25

35. Brian and Miguel decide to have a race. Miguel decides to give Brian a 20-meter lead at the beginning of the race. Brian runs at a speed of $2\dfrac{1}{2}$ meters per second. Miguel runs at a speed of 5 meters per second. If they start running at the same time, how many seconds will it take Miguel to catch Brian?

- **A.** $2\dfrac{1}{2}$
- **B.** 4
- **C.** 8
- **D.** $12\dfrac{1}{2}$
- **E.** 20

36. A marathon director is looking to define the rectangular starting area for an upcoming race. She has determined that she needs 64 square meters of space for the starting area, which will be delineated by rope barriers. What is the minimum length, in meters, of rope needed to enclose the starting area?

- **F.** 8
- **G.** 16
- **H.** 32
- **J.** 40
- **K.** 64

44. If $h\left(x\right)=\dfrac{1}{x^2}$ and $j(x) = x + 3$, what is $j(h(x))$?

- **F.** $\dfrac{x+3}{x^2}$
- **G.** $\dfrac{x^2+3}{x^2}$
- **H.** $\dfrac{1}{x^2}+3$
- **J.** $\dfrac{1}{x^2+3}$
- **K.** $\dfrac{1}{(x+3)^2}$

45. Function f is defined as $f(x)=\dfrac{3}{x}$. If $\dfrac{1}{7}<f(a)<\dfrac{1}{6}$, where a is an integer, which of the following lists all possible values of a ?

  A. 19 only
  B. 20 only
  C. 19 and 20
  D. 18, 19, 20, and 21
  E. There are no possible values of a.

47. If b is an integer, then the difference of $3b$ and $7b$ is *always* divisible by which of the following?

  A. 3
  B. 4
  C. 7
  D. 10
  E. 21

51. What real value of x satisfies the equation $27^{x+2}=\dfrac{3^2}{9^{x-3}}$?

  A. -1

  B. $\dfrac{2}{5}$

  C. $\dfrac{3}{2}$

  D. 2

  E. 3

52. On her first 6 rounds of golf this season, Mary has an average of s strokes per round. If Mary wants to decrease her average strokes per round to $s-3$ strokes, how many fewer strokes than s must she take during the 7th round?

  F. 3
  G. 7
  H. 18
  J. 21
  K. 25

53. Let x and y be real numbers. If $(x-y)^2=-2xy$, it *must* be true that:

  A. both x and y are zero.
  B. both x and y are negative.
  C. both x and y are fractions.
  D. either x or y is zero.
  E. x is positive and y is negative.

56. Let $ʁx$ be equal to the average (arithmetic mean) of the first x positive integers. For example, $ʁ6$ $=\dfrac{6+5+4+3+2+1}{6}=3.5$. For all positive integers, $x,$ which of the following statements, if any, are true?

    I. $ʁx+ʁ(x-1)=ʁ(2x)$

    II. $ʁx=\dfrac{x+1}{2}$

    III. $(ʁx)^2=ʁx^2$

  F. I only
  G. I and II only
  H. II only
  J. III only
 **K.** None

DRILL 3—WORD PROBLEMS AND ADVANCED MATH

24. Pete's Artisanal Pickles sells gourmet pickles at farmer's markets. Two types of machines—sealing machines and labeling machines—are used to jar the pickles. Each sealing machine processes jars at the rate of 30 jars per minute, and each labeling machine processes jars at the rate of 2 jars per second. Pete's Artisanal Pickles is currently using 16 sealing machines. How many labeling machines should be used so that the sealing machines and the labeling machines process the same number of jars in 1 *minute*?

    F.   2
    G.   4
    H.   8
    J.   15
    K.   20

32. In the standard (x,y) coordinate plane, what are the coordinates of the center of the circle with equation $(x + 3)^2 + (y + \sqrt{7})^2 = 4$?

    F. $(\ \sqrt{7},\ \ \ 3)$
    G. $(-\sqrt{7},\ -3)$
    H. $(\ \ \ 3, -\sqrt{7})$
    J. $(\ \ \ 3,\ \ \sqrt{7})$
    K. $(\ -3, -\sqrt{7})$

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

    F. $\dfrac{5\pi}{2}$

    G. 2π

    H. $\dfrac{3\pi}{2}$

    J. π
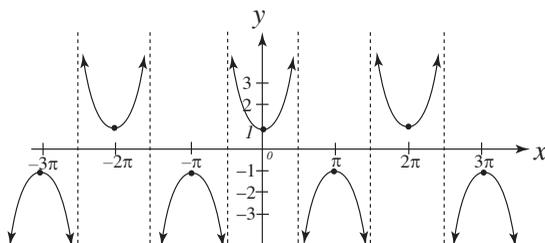
    K. $\dfrac{\pi}{2}$

44. The number of hours it takes a team of workers to assemble a certain type of machine varies directly with the number of machines and inversely with the square of the number of workers on the team. If c represents the constant of variation, which of the following expressions represents the number of hours it will take n workers to assemble x machines?

F. $\dfrac{cx}{n^2}$

G. $\dfrac{cn^2}{x}$

H. $\dfrac{xn^2}{c}$

J. $\dfrac{c}{xn^2}$

K. cxn^2

49. Each player of a certain game starts on the #10 space of a board with spaces numbered 1 through 150. A player flips a coin and moves forward 6 spaces for each time the coin lands on heads and moves backward 3 spaces for each time the coin lands on tails. Sven's coin landed on heads twice as many times as it landed on tails, moving him to the #100 space on the board. How many times did Sven's coin land on heads?

A. 5
B. 10
C. 15
D. 20
E. 25

50. In the standard (x,y) coordinate plane, when $f \neq 0$ and $g \neq 0$, where does the graph of $h(x) = \dfrac{3x + g}{x + f}$ have a *horizontal* asymptote?

F. $y = -\dfrac{g}{f}$

G. $y = \dfrac{g}{3}$

H. $y = -g$

J. $y = f$

K. $y = 3$

52. The stem-and-leaf plot below shows the scores received on a given test by the 32 students in Mrs. Brown's algebra class. What was the median score on this algebra test?

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

Key: 5 | 1 = 51

F. 72
G. 73
H. 74
J. 76
K. 77

53. Angle R has a measure of $\frac{35}{4}\pi$ radians. Angle R and angle S are coterminal. Angle S could have which of the following measures?

A. 12°
B. 36°
C. 45°
D. 90°
E. 135°

56. For all x such that $\cos x \neq 0$, the expression $\frac{\csc x \cdot \tan x}{\cos^2 x}$ is equivalent to which of the following?

(Note: $\sec x = \frac{1}{\cos x}$; $\csc x = \frac{1}{\sin x}$;

$\tan x = \frac{\sin x}{\cos x}$)

F. $\csc^2 x$
G. $\csc^2 x \cdot \tan x$
H. $\sec^3 x$
J. $\sin x$
K. 1

59. Consecutive terms of a certain geometric sequence have a constant integer ratio between adjacent terms. The product of the first three terms of the sequence is 1,728. Which of the following values CANNOT be the first term of the geometric sequence?

A. 7
B. 6
C. 4
D. 3
E. 2