## 1.5 Start Thinking

Sometimes equations have more than one unknown variable. In these types of equations, it is still possible to solve the equation for one of the variables. When solving equations with more than one unknown variable, how can you decide which operations to use to isolate one of the variables?
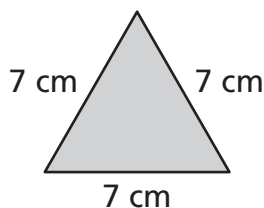
1.5 Warm Up

Use the information to find the measurement.

1. Find the area.

4 in.

10 in.
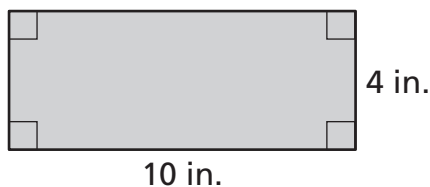
2. Find the perimeter.

7 cm   7 cm

7 cm

3. Find the circumference. Use 3.14 for π.

6 in.
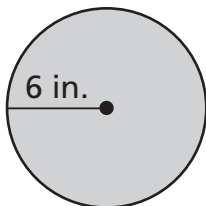
1.5 Cumulative Review Warm Up

Solve the equation.

1. $y - 4 = 9$

2. $p + 5 = -6$

3. $6h = 18$

4. $\dfrac{x}{-2} = 5$

5. $4 - u = 2$

6. $-y = 2.3$

Name_____ Date _____

1.5 Practice A

In Exercises 1–6, solve the literal equation for _y_.

1. $4x + y = 7$

2. $y - 5x = 9$

3. $3y - 15x = 12$

4. $8x + 2y = 18$

5. $7x - y = 35$

6. $4x + 1 = 9 + 4y$

In Exercises 7–12, solve the literal equation for _x_.

7. $y = 5x - 2x$

8. $r = x + 9x$

9. $b = 3x + 9xy$

10. $w = 2hx - 11x$

11. $p = 4x + qx - 5$

12. $m = 9 + 3x - dx$

13. The total cost C (in dollars) to participate in a triathlon series is given by the literal equation $C = 90x + 35,$ where x is the number of triathlons in which you participate.

    a. Solve the equation for x.

    b. In how many triathlons do you participate if you spend a total of $305? $665?

    c. If your maximum annual triathlon cost is $1000, what is the maximum number of triathlons in which you could participate?

In Exercises 14–16, solve the formula for the indicated variable.

14. Force: $f = ma;$ Solve for m.

15. Volume of a cylinder: $V = \pi r^2 h;$ Solve for h.

16. Perimeter of a triangle: $P = a + b + c;$ Solve for b.

17. You deposit $1500 in an account that earns simple interest at an annual rate of 3%.

    a. How long must you leave the money in the account to earn $900 in interest?

    b. The total amount (principle plus interest) in an account earning simple interest after t years is given by the formula $A = p + prt.$ How much is in the account after 5 years?

    c. Solve the equation in part (b) for p.

Name _____ Date _____

1.5 Practice B

In Exercises 1–6, solve the literal equation for _y_.

1. $3y - 9x = 24$

2. $10 - 2y = 46$

3. $3x + 5 = 9 - 4y$

4. $-5x + 7y = 8x + 7$

5. $3 + \dfrac{1}{5}y = 2x + 4$

6. $10 - \dfrac{1}{3}y = 4 + 6x$

In Exercises 7–14, solve the literal equation for _x_.

7. $g = 4x + 5xy$

8. $w = 4ax - 9x$

9. $z = 6x + px + 2$

10. $t = 10 + 7x - qx$

11. $ax - bx = k$

12. $p = qx + rx + s$

13. $11 - 4x - 3jx = w$

14. $x - 8 + 3vx = y$

15. Describe and correct the error in solving the equation for _x_.

$$
\begin{aligned}
k &= ax + bx + d \\
k &= x(a + b + d) \\
x &= \frac{k}{a + b + d}
\end{aligned}
$$

In Exercises 16–18, solve the equation for the indicated variable.

16. Simple interest: $I = prt$; Solve for _r_.

17. Volume of a box: $V = \ell wh$; Solve for _w_.

18. Heron's formula: $2S = a + b + c$; Solve for _b_.

19. Coulomb's Law is given by the formula

$$F = k\frac{q_1 q_2}{d^2}.$$

The force _F_ between two charges q_1 and q_2 in a vacuum is proportional to the product of the charges, and is inversely proportional to the square of the distance _d_ between the two charges. Solve the formula for _k_.

20. You deposit $800 in an account that earns simple interest at an annual rate of 5%. How long must you leave the money in the account to earn $100 in interest?

1.5 Enrichment and Extension

Draining a Bathtub

Evangelista Torricelli was an Italian mathematician and physicist. He is best known for his invention of the barometer, but he is also well known for his law regarding the speed of fluid flowing out of an opening. For a bathtub with a rectangular base, *Torricelli's Law* implies that the current height h of the water in the tub t seconds after it begins draining is given by the equation

$$h = \left[\sqrt{h_0} - \frac{2\pi d^2 \sqrt{3}}{\ell w} t \right]^2$$

where ℓ and w are the tub's length and width, d is the diameter of the drain, and h_0 is the water's initial height. (All measurements are in inches.)

Suppose you fill a tub completely with water. The tub is 60 inches long by 30 inches wide by 25 inches high, and has a drain with a 2-inch diameter.

Use the equation above to answer the following questions. Round to the nearest hundredth.

   1. Solve for t.

   2. a. Find the time it takes for the tub to go from being full to half full.

      b. Find the time it takes for the tub to go from being half full to empty.

   3. Find the time it takes for the tub to go from being full to empty.

   4. Use a graphing calculator to graph the height of the water versus time. (The y-axis is the height (in inches), and the x-axis is the time (in seconds) in intervals of 30 seconds.)

   5. Based on your results from Exercises 1–4, what general statement can you make about the speed at which the water drains? Explain your answer.

      Bonus: Is it possible to *rationalize* the denominator after solving for t?

1.5 Puzzle Time

What Happened To The Shark Who Swallowed A Bunch Of Keys?

Write the letter of each answer in the box containing the exercise number.

Solve the literal equation for *y*.

1. $y + 5x = 17$

2. $4y - 36x = 28$

3. $8x - 11 = 13 + 8y$

4. $6 + \frac{1}{3}y = 10 + 12x$

Solve the literal equation for *x*.

5. $y = 9x - 2x$

6. $d = 5x + 10xf$

7. $rx - sx = p$

8. $3j = 4kx + 7mx + n$

Solve the equation for the indicated variable.

9. Volume of a cone: $V = \frac{1}{3}\pi r^2 h$; Solve for *h*.

10. Perimeter of a rectangle: $P = 2\ell + 2w$; Solve for *w*.

11. Area of a rectangle: $A = \ell w$; Solve for ℓ.

12. The surface area of a right circular cylinder is given by the formula $S = 2\pi rh + 2\pi r^2$. Solve the equation for *h*.

Answers

O. $y = x - 3$

W. $x = \dfrac{3j - n}{4k + 7m}$

T. $x = \dfrac{d}{5 + 10f}$

O. $y = 9x + 7$

E. $y = -5x + 17$

G. $h = \dfrac{3V}{\pi r^2}$

K. $y = 36x + 12$

H. $x = \dfrac{p}{r - s}$

L. $\ell = \dfrac{A}{w}$

A. $x = \dfrac{1}{7}y$

C. $w = \dfrac{P - 2\ell}{2}$

J. $h = \dfrac{S - 2\pi r^2}{2\pi r}$

7	1		9	3	6		11	2	10	4	12	5	8