

LESSON

Reteach

2-5 Solving for a Variable

Solving for a variable in a formula can make it easier to use that formula. The process is similar to that of solving multi-step equations. Find the operations being performed on the variable you are solving for, and then use inverse operations.

	Operations	Solve using Inverse Operations
$A = lw$ Solve for w .	<ul style="list-style-type: none"> w is multiplied by l. 	<ul style="list-style-type: none"> Divide both sides by l.
$P = 2l + 2w$ Solve for w .	<ul style="list-style-type: none"> w is multiplied by 2. Then $2l$ is added. 	<ul style="list-style-type: none"> Add $-2l$ to both sides. Then divide both sides by 2.

The formula $A = \frac{1}{2}bh$ relates the area A of a triangle to its base b and height h . Solve the formula for b .

$A = \frac{1}{2}bh$ b is multiplied by $\frac{1}{2}$.

$\left(\frac{2}{1}\right) \cdot A = \left(\frac{2}{1}\right)\frac{1}{2}bh$ Multiply both sides by $\frac{2}{1}$.

$2A = bh$ b is multiplied by h .

$\frac{2A}{h} = \frac{bh}{h}$ Divide both sides by h .

$\frac{2A}{h} = b$ Simplify.

The order of the inverse operations is the order of operations in reverse.

Solve for the indicated variable.

1. $P = 4s$ for s

2. $a + b + c = 180$ for b

3. $P = \frac{KT}{V}$ for K

The formula $V = \frac{1}{3}lwh$ relates the volume of a square pyramid to its base length l , base width w , and height h .

4. Solve the formula for w .

5. A square pyramid has a volume of 560 in^3 , a base length of 10 in., and a height of 14 in. What is its base width?

LESSON

Reteach**2-5 Solving for a Variable** continued

Any equation with two or more variables can be solved for any given variable.

Solve $x = \frac{y - z}{10}$ for y .

$$x = \frac{y - z}{10} \quad y - z \text{ is divided by } 10.$$

$$10(x) = 10\left(\frac{y - z}{10}\right) \quad \text{Multiply both sides by } 10.$$

$$10x = y - z \quad z \text{ is subtracted from } y. \text{ Add } z \text{ to both sides.}$$

$$\underline{+z} \quad \underline{+z}$$

$$10x + z = y$$

Solve $a = b + \frac{c}{d}$ for c .

$$a = b + \frac{c}{d}$$

$$\underline{-b} \quad \underline{-b} \quad \text{Add } -b \text{ to each side.}$$

$$a - b = \frac{c}{d}$$

$$d(a - b) = \left(\frac{c}{d}\right)d \quad \text{Multiply both sides by } d.$$

$$d(a - b) = c \quad \text{Simplify.}$$

State the first inverse operation to perform when solving for the indicated variable.

6. $y = x + z$; for z _____

7. $\frac{f + g}{2} = h$; for g _____

8. $t = -3r + \frac{s}{5}$; for s _____

Solve for the indicated variable.

9. $3ab = c$; for a _____

10. $y = x + \frac{z}{3}$; for z _____

11. $\frac{m + 3}{n} = p$; for m _____

LESSON **Practice A**
2-5 Solving for a Variable

Answer each of the following.

1. The formula $K = C + 273$ is used to convert temperatures from degrees Celsius to Kelvin. Solve this formula for C .
2. The formula $T = \frac{1}{f}$ relates the period of a sound wave T to its frequency f . Solve this formula for f .

$$C = K - 273$$

$$f = \frac{1}{T}$$

Solve each equation for the variable indicated.

3. $x = 5y$ for y 4. $s + 4t = r$ for s 5. $3m - 7n = p$ for m
- $$y = \frac{x}{5} \quad s = r - 4t \quad m = \frac{p + 7n}{3}$$
6. $6 = hj + k$ for j 7. $\frac{v}{w} = 9$ for w 8. $\frac{a+3}{b} = c$ for a
- $$j = \frac{6-k}{h} \quad w = \frac{v}{9} \quad a = bc - 3$$

Answer each of the following.

9. The formula $d = rt$ relates the distance an object travels d , to its average rate of speed r , and amount of time t that it travels.
- a. Solve the formula $d = rt$ for t . $t = \frac{d}{r}$
- b. How many hours would it take for a car to travel 150 miles at an average rate of 50 miles per hour? 3
10. The formula $F - E + V = 2$ relates the number of faces F , edges E , and vertices V , in any convex polyhedron.
- a. Solve the formula $F - E + V = 2$ for F . $F = 2 + E - V$
- b. How many faces does a polyhedron with 20 vertices and 30 edges have? 12

Copyright © by Holt, Rinehart and Winston. All rights reserved.

35

Holt Algebra 1

LESSON **Practice B**
2-5 Solving for a Variable

Answer each of the following.

1. The formula $C = 2\pi r$ relates the radius r of a circle to its circumference C . Solve the formula for r .
2. The formula $y = mx + b$ is called the slope-intercept form of a line. Solve this formula for m .

$$r = \frac{C}{2\pi}$$

$$m = \frac{y-b}{x}$$

Solve each equation for the variable indicated.

3. $4c = d$ for c 4. $n - 6m = 8$ for n 5. $2p + 5r = q$ for p
- $$c = \frac{d}{4} \quad n = 8 + 6m \quad p = \frac{q - 5r}{2}$$
6. $-10 = xy + z$ for x 7. $\frac{a}{b} = c$ for b 8. $\frac{h-4}{j} = k$ for j
- $$x = \frac{-10-z}{y} \quad b = \frac{a}{c} \quad j = \frac{h-4}{k}$$

Answer each of the following.

9. The formula $c = 5p + 215$ relates c , the total cost in dollars of hosting a birthday party at a skating rink, to p , the number of people attending.
- a. Solve the formula $c = 5p + 215$ for p . $p = \frac{c - 215}{5}$
- b. If Allie's parents are willing to spend \$300 for a party, how many people can attend? 17
10. The formula for the area of a triangle is $A = \frac{1}{2}bh$, where b represents the length of the base and h represents the height.
- a. Solve the formula $A = \frac{1}{2}bh$ for b . $b = \frac{2A}{h}$
- b. If a triangle has an area of 192 mm², and the height measures 12 mm, what is the measure of the base? 32 mm

Copyright © by Holt, Rinehart and Winston. All rights reserved.

36

Holt Algebra 1

LESSON **Practice C**
2-5 Solving for a Variable

Answer each of the following.

1. The formula $P = 2l + 2w$ relates the perimeter P of a rectangle to its length l and width w . Solve this formula for w .
2. The formula $a = \frac{v_f - v_i}{t}$ is used to find an object's acceleration given initial velocity v_i , final velocity v_f , and time t . Solve this formula for v_f .

$$w = \frac{P - 2l}{2}$$

$$v_f = at + v_i$$

Solve each literal equation for the variable indicated.

3. $-3f = g$ for f 4. $12 = a + 5b$ for a 5. $3x - 7y = z$ for x
- $$f = \frac{g}{-3} \quad a = 12 - 5b \quad x = \frac{z + 7y}{3}$$
6. $5h - g = jk$ for h 7. $\frac{r}{s} = t - 9$ for r 8. $\frac{m+3}{n} = p$ for n
- $$h = \frac{jk + g}{5} \quad r = s(t - 9) \quad n = \frac{m + 3}{p}$$

Answer each of the following.

9. The formula $F = ma$ relates the force F exerted on an object, to the object's mass m , and acceleration a .
- a. Solve the formula $F = ma$ for a . $a = \frac{F}{m}$
- b. Suppose a shot-putter exerts a force of 123.5 kg · m/s² on a shot that has a mass of 6.5 kg. What is the rate of acceleration of the shot? (The answer will be in m/s².) 19 m/s^2
10. The formula $I = Prt$ can be used to determine the interest I that is earned on a principal amount of money P , when the money is invested at an annual percentage rate r for t years.
- a. Solve the formula $I = Prt$ for t . $t = \frac{I}{Pr}$
- b. If a couple invests \$5000 in an account that earns a 3% interest rate, how long will they need to invest it to earn \$1200 in interest? (Hint: Convert the interest rate to a decimal.) 8 years

Copyright © by Holt, Rinehart and Winston. All rights reserved.

37

Holt Algebra 1

LESSON **Reteach**
2-5 Solving for a Variable

Solving for a variable in a formula can make it easier to use that formula. The process is similar to that of solving multi-step equations. Find the operations being performed on the variable you are solving for, and then use inverse operations.

	Operations	Solve using Inverse Operations
$A = lw$ Solve for w .	<ul style="list-style-type: none">w is multiplied by l.	<ul style="list-style-type: none">Divide both sides by l.
$P = 2l + 2w$ Solve for w .	<ul style="list-style-type: none">w is multiplied by 2.Then $2l$ is added.	<ul style="list-style-type: none">Add $-2l$ to both sides.Then divide both sides by 2.

The formula $A = \frac{1}{2}bh$ relates the area A of a triangle to its base b and height h . Solve the formula for b .

$$A = \frac{1}{2}bh \quad b \text{ is multiplied by } \frac{1}{2}$$

$$\left(\frac{2}{1}\right) \cdot A = \left(\frac{2}{1}\right) \frac{1}{2}bh \quad \text{Multiply both sides by } \frac{2}{1}$$

$$2A = bh \quad b \text{ is multiplied by } h$$

$$\frac{2A}{h} = \frac{bh}{h} \quad \text{Divide both sides by } h$$

$$\frac{2A}{h} = b \quad \text{Simplify.}$$

The order of the inverse operations is the order of operations in reverse.

Solve for the indicated variable.

1. $P = 4s$ for s 2. $a + b + c = 180$ for b 3. $P = \frac{KT}{V}$ for K
- $$s = \frac{P}{4} \quad b = 180 - a - c \quad K = \frac{VP}{T}$$

The formula $V = \frac{1}{3}lwh$ relates the volume of a square pyramid to its base length l , base width w , and height h .

4. Solve the formula for w . $w = \frac{3V}{lh}$
5. A square pyramid has a volume of 560 in³, a base length of 10 in., and a height of 14 in. What is its base width? 12 in.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

38

Holt Algebra 1

LESSON **Reteach**

2-3 Solving for a Variable continued

Any equation with two or more variables can be solved for any given variable.

Solve $x = \frac{y-z}{10}$ for y .

$x = \frac{y-z}{10}$ $y - z$ is divided by 10.

$10(x) = 10\left(\frac{y-z}{10}\right)$ Multiply both sides by 10.

$10x = y - z$ z is subtracted from y . Add z to both sides.

$+z$ $+z$

$10x + z = y$

Solve $a = b + \frac{c}{d}$ for c .

$a = b + \frac{c}{d}$

$-b$ $-b$ Add $-b$ to each side.

$a - b = \frac{c}{d}$

$d(a - b) = \left(\frac{c}{d}\right)d$ Multiply both sides by d .

$d(a - b) = c$ Simplify.

State the first inverse operation to perform when solving for the indicated variable.

6. $y = x + z$; for z add $-x$ to both sides

7. $\frac{f+g}{2} = h$; for g multiply both sides by 2

8. $t = -3r + \frac{s}{5}$; for s add $3r$ to both sides

Solve for the indicated variable.

9. $3ab = c$; for a $a = \frac{c}{3b}$

10. $y = x + \frac{z}{3}$; for z $z = 3(y - x)$

11. $\frac{m+3}{n} = p$; for m $m = pn - 3$

LESSON **Challenge**

2-5 A Formula of Interest

When you put your money in a savings account, the bank may pay you *simple interest*. Let P represent the dollar amount of your deposit (the principal), let r represent the interest rate, and let t represent the number of years. The amount of interest you earn, I , is given by the *simple interest formula*: $I = Prt$.

Note that banks typically use percents to describe their interest rates. Percent means "per hundred," so an interest rate of 5% means that you should use $r = \frac{5}{100}$, or 0.05.

Use the simple interest formula to solve the following problems:

- If $P = 2500$, $r = 0.03$, and $t = 5$, what is I ? $I = 375$
- If $r = 0.025$, $t = 3$, and $I = 150$, what is P ? $P = 2000$
- If $P = 500$, $r = 0.06$, and $I = 150$, what is t ? $t = 5$ years
- If $P = 3000$, $t = 4$, and $I = 384$, what is r ? $r = 0.032$ or 3.2%
- Kevin is making a deposit of \$1800 at his local bank. The bank pays 6.5% simple interest ($r = 0.065$). If Kevin leaves his deposit at the bank for 3 years, how much interest will he earn? \$351
- Cecelia made a deposit of \$600 at a bank paying 4% simple interest ($r = 0.04$). How long should she leave her deposit at the bank in order to earn \$72 in interest? 3 years
- Darryl opened an account at a bank which paid 5.5% simple interest ($r = 0.055$). After 6 years, he had earned \$726 in interest. What was the amount of his original deposit? \$2200
- Sophia deposited \$150 at a savings and loan association paying simple interest. If she earned \$27 in interest after 6 years, what was the interest rate? 0.03 or 3%
- Nathan made a deposit of \$650 at a bank paying 3.8% simple interest ($r = 0.038$). If he leaves his deposit at the bank for 10 years, how much interest will he earn? \$247
- Susie made a deposit of \$980 at a credit union paying 7% simple interest ($r = 0.07$). How long should she leave her deposit at the credit union in order to earn \$343 in interest? 5 years
- Guillermo deposited \$1350 at a bank paying simple interest. If he earned \$109.35 in 3 years, what was the interest rate? 0.027 or 2.7%

LESSON **Problem Solving**

2-5 Solving for a Variable

Use the table below, which shows some track and field gold medal winners, to answer questions 1–4. Round all answers to the nearest tenth.

1. Solve the formula $d = rt$ for r .

$r = \frac{d}{t}$

2. Find Johnson's average speed in meters per second.

9.1 m/s

3. Find Garcia's average speed in meters per second.

8.5 m/s

4. The world record of 19.32 seconds in the 200-meter race was set by Michael Johnson in 1996. Find the difference between Johnson's average speed and Kenteris' average speed.

0.4 m/s

Select the best answer.

5. The cost to mail a letter in the United States is \$0.34 for the first ounce and \$0.23 for each additional ounce. Solve $C = 0.34 + 0.23(z - 1)$ for z .

A $z = \frac{C - 0.34}{0.23}$

B $z = \frac{C - 0.34}{0.23} + 1$

C $z = \frac{C + 0.11}{0.23}$

D $z = C - 0.56$

7. Degrees Celsius and degrees Fahrenheit are related by the equation $C = \frac{5}{9}(F - 32)$. Solve for F .

A $F = 9C + 27$ C $F = \frac{5}{9}C + 32$

B $F = \frac{9}{5}C$ D $F = \frac{9}{5}C + 32$

2000 Summer Olympics		
Gold Medal Winner	Race	Time (s)
M. Greene, USA	100 m	9.87
K. Kenteris, Greece	200 m	20.09
M. Johnson, USA	400 m	43.84
A. Garcia, Cuba	110 m hurdles	13.00

6. The formula $V = \frac{Bh}{3}$ shows how to find the volume of a pyramid. Solve for B .

F $B = \frac{3V}{h}$ H $B = 3Vh$

G $B = 3V - h$ J $B = 3V + h$

8. The cost of operating an electrical device is given by the formula $C = \frac{Wt}{1000}$ where W is the power in watts, t is the time in hours, and c is the cost in cents per kilowatt-hour. Solve for W .

F $W = 1000C - tc$

G $W = \frac{Ctc}{1000}$

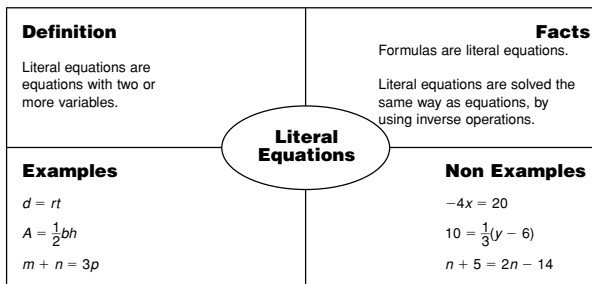
H $W = 1000C + tc$

J $W = \frac{1000C}{tc}$

LESSON **Reading Strategies**

2-5 Use a Concept Map

Use the concept map below to help you understand literal equations.



Answer each question.

- Give your own example of a literal equation.
Possible answer: $3x + 2y = 9$
- Why is $n + 5 = 2n - 14$ given as a non-example?
The equation contains only one variable, n .
- Is an equation with four different variables a literal equation? Why?
Yes, because it has two or more variables.
- Describe how to solve $d = rt$ for t .
Divide both sides by r .
- Solve the literal equation $3t + 8 = b$ for t .
 $t = \frac{b - 8}{3}$
- The formula for the volume of a rectangular prism is $V = lwh$.
a. Solve this formula for h .
 $h = \frac{V}{lw}$
b. Find the height of a rectangular prism with a volume of 189 cm^3 , a length of 9 cm, and a width of 7 cm.
3 cm