2-8 Notes
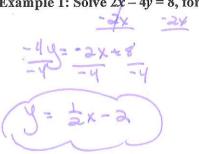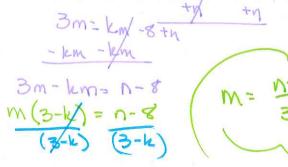## *Literal Equations*

Solve for Variables Sometimes you may want to solve an equation such as $V = \ell wh$ for one of its variables. For example, if you know the values of V, w, and h, then the equation $\ell = \dfrac{V}{wh}$ is more useful for finding the value of ℓ. If an equation that contains more than one variable is to be solved for a specific variable, use the properties of equality to isolate the specified variable on one side of the equation.
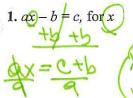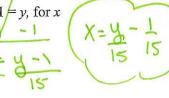
Example 1: Solve $2x - 4y = 8$, for y.

$$-4y = -2x + 8$$
$$\frac{-4y}{-4} = \frac{-2x}{-4} + \frac{8}{-4}$$
$$y = \tfrac{1}{2}x - 2$$

Example 2: Solve $3m - n = km - 8$, for m.

$$3m = km - 8 + n$$
$$-km \quad -km$$
$$3m - km = n - 8$$
$$m(3-k) = n - 8$$
$$\frac{m(3-k)}{(3-k)} = \frac{n-8}{(3-k)}$$
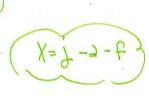$$m = \frac{n-8}{3-k}$$

Exercises
Solve each equation or formula for the variable indicated.

1. $ax - b = c$, for x

$$+b \quad +b$$
$$\frac{ax}{a} = \frac{c+b}{a} \qquad x = \frac{c+b}{a}$$

2. $15x + 1 = y$, for x

$$-1 \quad -1$$
$$\frac{15x}{15} = \frac{y-1}{15} \qquad x = \frac{y}{15} - \frac{1}{15}$$

3. $(x + f) + 2 = j$, for x

$$x + f + 2 = j$$
$$-2 \quad -2$$
$$x + f = j - 2$$
$$-f \qquad -f$$
$$x = j - 2 - f$$

4. $xy + w = 9$, for y

$$-w \quad -w$$
$$\frac{xy}{x} = \frac{9-w}{x} \qquad y = \frac{9-w}{x}$$

5. $x(4 - k) = p$, for k

$$\frac{x(4-k)}{x} = \frac{p}{x}$$
$$4 - k = \frac{p}{x} - 4$$
$$-4$$
$$k = -\frac{p}{x} + 4$$

6. $\dfrac{x}{n} + t = 4v$, for x

$$-t \quad -t$$
$$n\left(\frac{x}{n}\right) = (4v - t)n$$
$$x = 4vn - tn$$

10. $16w + 4x = y$, for x

$$-16w \quad -16w$$
$$\frac{4x}{4} = \frac{y-16w}{4}$$
$$x = \frac{y}{4} - 4w$$

11. $d = rt$, for r

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

12. $A = \dfrac{h(a+b)}{2}$, for h

$$2A = h(a+b)$$
$$\frac{2A}{(a+b)} = \frac{h(a+b)}{(a+b)}$$
$$h = \frac{2a}{a+b}$$

13. $C = \dfrac{5}{9}(F - 32)$, for F

$$\frac{9}{5}C = F - 32$$
$$+32 \qquad +32$$
$$32 + \frac{9}{5}C = F$$

14. $P = 2\ell + 2w$, for w

$$-2\ell \quad -2\ell$$
$$\frac{P - 2\ell}{2} = \frac{2w}{2}$$
$$w = \frac{P}{2} - \ell$$

15. $A = \ell w$, for ℓ

$$\frac{A}{w} = \frac{\ell w}{w}$$
$$\ell = \frac{A}{w}$$

Use Formulas Many real-world problems require the use of formulas. Sometimes solving a formula for a specified variable will help solve the problem.

Example: The formula $C = \pi d$ represents the circumference of a circle, or the distance around the circle, where d is the diameter. If an airplane could fly around Earth at the equator without stopping, it would have traveled about 24,900 miles. Find the diameter of Earth.

$$\frac{C}{\pi} = \frac{\pi d}{\pi} \qquad d = \frac{C}{\pi} \qquad d = \frac{24,900}{\pi} \qquad d = 7925.916 \text{ miles}$$

These following are useful literal equations you should know how to solve for the variable y. You should be able to possess an automatic skill in re-arranging these formulas to isolate y.

$Ax + By = C$	$-Ax + By = C$	$Ax - By = C$	$-Ax - By = C$
$Ax + By = -C$	$-Ax + By = -C$	$Ax - By = -C$	$-Ax - By = -C$

$$y = \frac{A}{B}x + \frac{C}{B} \text{ solve for } C$$

✱ change sign on A b/c moves to other side of equal sign then divide all terms by B.

Write the slope-intercept form of the equation of each line.

1) $3x - 2y = -16$

$-2y = -3x - 16$

$y = 3/2x + 8$

2) $13x - 11y = -12$

$-11y = -13x - 12$

$y = \frac{13}{11}x + \frac{12}{11}$

3) $9x - 7y = -7$

$-7y = -9x - 7$

$y = \frac{9}{7}x + 1$

4) $x - 3y = 6$

$-3y = -x + 6$

$y = \frac{1}{3}x - 2$

5) $6x + 5y = -15$

$5y = -6x - 15$

$y = \frac{-6}{5}x - 3$

6) $4x - y = 1$

$-y = -4x + 1$

$y = 4x - 1$

7) $11x - 4y = 32$

$-4y = -11x + 32$

$y = \frac{11}{4}x - 8$

8) $11x - 8y = -48$

$-8y = -11x - 48$

$y = \frac{11}{8}x + 6$