

Warm Up:

**Simplify each expression.**

1.  $2x + 5 - 3x$   
 $-x + 5$

3.  $6(2 - 3g)$

$12 - 18g$

2.  $-(w - 2)$

$-w + 2$

Believe you can and you're halfway there.

-Theodore Roosevelt

**2-1 Solving Linear Equations and Inequalities*****Objectives***

Solve linear equations using a variety of methods.

Solve linear inequalities.

**2-1 Solving Linear Equations and Inequalities*****Vocabulary***

equation

solution set of an equation

linear equation in one variable

identify

contradiction

inequality

## 2-1 Solving Linear Equations and Inequalities

$$\curvearrowright = \quad \begin{array}{l} \curvearrowright x = 7 \\ x = 1 \end{array}$$

An **equation** is a mathematical statement that two expressions are equivalent. The **solution set of an equation** is the value or values of the variable that make the equation true. A **linear equation in one variable** can be written in the form  $ax = b$ , where  $a$  and  $b$  are constants and  $a \neq 0$ .

## 2-1 Solving Linear Equations and Inequalities

### Linear Equations in One variable

$$4x = 8$$

$$3x - \frac{2}{3}x = -9$$

$$2x - 5 = 0.1x + 2$$

### Nonlinear Equations

$$3\sqrt{x} + 1 = 32$$

$$\frac{2}{x^2} + 1 = 41$$

$$3 - 2^x = -5$$

We will start off by solving for variables. Stuff you have been doing since Algebra I. To get the variable by itself do the inverse (opposite) operations and get it by itself.

Steps:

- 1) Simplify by Distributive Property and combining like terms.
- 2) Get variable by itself.

## 2-1

## Solving Linear Equations and Inequalities

### Example 1: Consumer Application

The local phone company charges \$12.95 a month for the first 200 of air time, plus \$0.07 for each additional minute. If Nina's bill for the month was \$14.56, how many additional minutes did she use?

$$\begin{array}{r}
 14.56 = 12.95 + .07x \\
 -12.95 \quad -12.95 \\
 \hline
 1.61 = .07x \\
 \hline
 \frac{1.61}{.07} = \frac{.07x}{.07} \\
 x = 23
 \end{array}$$

## 2-1 Solving Linear Equations and Inequalities

### Example 2: Solving Equations with the Distributive Property

Solve  $4(m + 12) = -36$

$$\begin{aligned}
 4m + 48 &= -36 \\
 -48 &-48 \\
 \hline
 4m &= -84 \\
 \hline
 m &= -21
 \end{aligned}$$

## 2-1 Solving Linear Equations and Inequalities

### Check It Out! Example 2a

Solve  $3(2 - 3p) = 42$ .

$$\begin{aligned}
 6 - 9p &= 42 \\
 -6 &-6 \\
 \hline
 -9p &= 36 \\
 \hline
 p &= -4
 \end{aligned}$$

**2-1 Solving Linear Equations and Inequalities****Check It Out! Example 2b**

Solve  $-3(5 - 4r) = -9$ .

**Method 1**

Sometimes variables are on both sides of the equation. This just adds an extra step. The first thing to do is get all the variables to one side by adding or subtracting  $x$  to move it to the other side.

## 2-1 Solving Linear Equations and Inequalities

### Example 3: Solving Equations with Variables on Both Sides

Solve  $3k - 14k + 25 = 2 - 6k - 12$ .

$$\begin{array}{r}
 -11k + 25 = -10 - 6k \\
 +11k \qquad \qquad \qquad +11k \\
 \hline
 25 = -10 + 5k \\
 +10 \qquad \qquad \qquad +10 \\
 \hline
 35 = 5k \\
 \frac{35}{5} = \frac{5k}{5} \\
 k = 7
 \end{array}$$

## 2-1 Solving Linear Equations and Inequalities

### Check It Out! Example 3

Solve  $3(w + 7) - 5w = w + 12$ .

$$\begin{array}{r}
 3w + 21 - 5w = w + 12 \\
 -2w + 21 = w + 12 \\
 -w \qquad \qquad \qquad -w \\
 \hline
 -3w + 21 = 12 \\
 -21 \qquad \qquad \qquad -21 \\
 \hline
 -3w = -9 \\
 \frac{-3w}{-3} = \frac{-9}{-3} \\
 w = 3
 \end{array}$$

Write an equation  
containing one variable.  
Have a partner solve it.

## 2-1 Solving Linear Equations and Inequalities

You have solved equations that have a single solution. Equations may also have infinitely many solutions or no solution.

An equation that is true for all values of the variable, such as  $x = x$ , is an **identity**. An equation that has no solutions, such as  $3 = 5$ , is a **contradiction** because there are no values that make it true.

$$7=7$$

$$7=5$$



Steps for identities and contradictions:

- 1) Solve like an equation with variables on both sides. The variables will disappear!
- 2) If the equation left is true (such as  $6=6$ ) then you have an identity. If it is false (such as  $4=7$ ) then you have a contradiction.

## 2-1 Solving Linear Equations and Inequalities

### Example 4A: Identifying Identities and Contractions

Solve  $3v - 9 - 4v = -(5 + v)$ .

$$\begin{array}{c} -v - 9 = -5 - v \\ +v \quad \quad \quad +v \end{array}$$

$$-9 = -5$$

Contradiction

## 2-1 Solving Linear Equations and Inequalities

### Example 4B: Identifying Identities and Contractions

Solve  $2(x - 6) = -5x - 12 + 7x$ .

$$\begin{array}{r} 2x - 12 = 2x - 12 \\ -2x \quad -2x \end{array}$$

$$-12 = -12$$

Identity

## 2-1 Solving Linear Equations and Inequalities

### Check It Out! Example 4a

Solve  $5(x - 6) = 3x - 18 + 2x$ .

$$\begin{array}{r} 5x - 30 = 5x - 18 \\ -5x \quad -5x \end{array}$$

$$-30 = -18$$

Contradiction

**2-1 Solving Linear Equations and Inequalities****Check It Out! Example 4b**

Solve  $3(2 - 3x) = -7x - 2(x - 3)$ .

$$3(2 - 3x) = -7x - 2(x - 3)$$

**2-1 Solving Linear Equations and Inequalities**

An **inequality** is a statement that compares two expressions by using the symbols  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ , or  $\neq$ . The graph of an inequality is the solution set, the set of all points on the number line that satisfy the inequality.

The properties of equality are true for inequalities, with one important difference. If you multiply or divide both sides by a negative number, you must *reverse* the inequality symbol.

Solving inequalities is the exact same as an equation, but remember...



When dividing or multiplying by a negative number the inequality sign has to flip the opposite way!

To graph:

- 1) Choose open or closed circle.
- 2) Test a number to see which way the arrow should point.

## 2-1 Solving Linear Equations and Inequalities

### Example 5: Solving Inequalities

Solve and graph  $8a - 2 \geq 13a + 8$ .

$$8a - 2 \geq 13a + 8$$

$$-8a$$

$$-8a$$

$$-2 \geq 5a + 8$$

$$-8$$

$$-8$$

$$\frac{-10}{5} \geq \frac{5a}{5}$$

$$-2 \geq a$$



**2-1 Solving Linear Equations and Inequalities****Check It Out! Example 5**

Solve and graph  $x + 8 \geq 4x + 17$ .

$$\begin{aligned}8 &\geq 3x + 17 \\ -9 &\geq 3x \\ -3 &\geq x\end{aligned}$$

Write yourself an inequality with one variable, solve it and graph it.

**2-2 Proportional Reasoning*****Objective***

Apply proportional relationships to rates, similarity, and scale.

**2-2 Proportional Reasoning*****Vocabulary***

ratio  
proportion  
rate  
similar  
indirect measurement

**2-2 Proportional Reasoning**

$$\frac{mi}{hr}$$

Recall that a **ratio** is a comparison of two numbers by division and a **proportion** is an equation stating that two ratios are equal. In a proportion, the cross products are equal.

$$\frac{7}{10} = \frac{x}{20}$$

Steps to solve a proportion:

- 1) Cross multiply...remember that you may have to use the distributive property.
- 2) Solve for the variable.

## 2-2 Proportional Reasoning

### Example 1: Solving Proportions

Solve each proportion.

A.  $\frac{16}{p} \propto \frac{24}{12.9}$

$$\frac{24p}{24} = \frac{206.4}{24}$$

$$p = 8.6$$

B.  $\frac{14}{88} \propto \frac{c}{132}$

$$\frac{88c}{88} = \frac{1848}{88}$$

$$c = 21$$

## 2-2 Proportional Reasoning

### Check It Out! Example 1

Solve each proportion.

A.  $\frac{y}{12} = \frac{77}{84}$

B.  $\frac{15}{x} \propto \frac{2.5}{7}$

$$\frac{105}{2.5} = \frac{2.5x}{2.5}$$

$$42 = x$$



Write your partner a proportion. Have them solve it, check their work.

Homework:

p. 94 #22-38(evens), 49

p. 101 #22-28(evens), 31, 53, 55

Present: 49, 53