

# 5.1 Rational Numbers

**Objective:** Write fractions as decimals and vice versa.

A \_\_\_\_\_ number is a number that can be written as the quotient of two integers.

A \_\_\_\_\_ is a decimal that has a final digit.

A \_\_\_\_\_ decimal is a decimal that has one or more digits that repeat without end.

## Example 1: Identifying Rational Numbers

Show that the number is rational by writing it as a quotient of two integers.

1.  $-12$

2.  $-2\frac{1}{4}$

## Check It Out!

Show that the number is rational by writing it as a quotient of two integers.

1.  $3$

2.  $4\frac{2}{3}$

## Example 2: Writing Fractions as Decimals

Write the following fractions as a decimal.

1.  $\frac{5}{16}$

2.  $\frac{4}{9}$

3.  $\frac{7}{20}$

## Check It Out!

Write the following fractions as a decimal.

1.  $-\frac{3}{5}$

2.  $2\frac{12}{25}$

3.  $\frac{23}{40}$

### Example 3: Using Decimals to Compare Fractions

Compare the following fractions.

1.  $\frac{42}{38}$  and  $\frac{27}{30}$

### Example 4: Writing Terminal Decimals as Fraction

Write the terminal decimal as a fraction.

1. 0.03

2. -9.4

### Check It Out!

Write the terminal decimal as a fraction.

1. 0.8

2. -3.75

### Example 5: Writing a Repeating Decimal as a Fraction

Write the repeating decimal as a fraction.

1.  $0.\overline{81}$

2.  $0.\overline{12}$

### Check It Out!

Write the repeating decimal as a fraction.

1.  $5.\overline{3}$

### Example 6: Ordering Rational Numbers

Order the numbers from least to greatest.

1.  $-\frac{17}{2}$ , -1.35, 5.67, -6,  $\frac{11}{3}$ ,  $-\frac{13}{4}$

## 5.2 Adding and Subtracting Like Fractions

**Objective:** Add and subtract like fractions.

### Adding and Subtracting Like Fractions

**Words** To add or subtract fractions with the same denominator, write the sum or difference of the numerators over the denominator.

**Numbers**  $\frac{4}{9} + \frac{1}{9} = \frac{\square}{9}$

$\frac{9}{11} - \frac{2}{11} = \frac{\square}{11}$

**Algebra**  $\frac{a}{c} + \frac{b}{c} = \frac{\square}{c}, c \neq 0$        $\frac{a}{c} - \frac{b}{c} = \frac{\square}{c}, c \neq 0$

### Example 1: Adding Like Fractions

Find the sum.

1.  $-\frac{4}{9} + \frac{3}{9}$

2.  $\frac{2}{7} + \frac{4}{7}$

### Check It Out!

Find the sum.

1.  $\frac{2}{11} + \left(-\frac{3}{11}\right)$

2.  $\frac{3}{8} + \frac{8}{8}$

### Example 2: Subtracting Like Fractions

Find the difference.

1.  $-\frac{4}{9} - \frac{3}{9}$

2.  $\frac{2}{7} - \frac{4}{7}$

### Check It Out!

Find the difference.

1.  $\frac{2}{11} - \left(-\frac{3}{11}\right)$

2.  $\frac{3}{8} - \frac{8}{8}$

### Example 3: Adding and Subtracting Mixed Numbers

Find the sum or difference.

1.  $4\frac{3}{7} + 3\frac{6}{7}$

2.  $11\frac{3}{10} - 8\frac{9}{10}$

### Check It Out!

Find the sum or difference.

1.  $3\frac{2}{11} + 5\frac{4}{11}$

2.  $-4\frac{5}{13} - 3\frac{6}{13}$

### Example 4: Simplifying Variable Expressions

Simplify.

1.  $\frac{4a}{21} + \frac{10a}{21}$

2.  $-\frac{9}{5b} - \left(-\frac{4}{5b}\right)$

### Check It Out!

Simplify.

1.  $\frac{2a}{25} + \frac{8a}{25}$

2.  $-\frac{17}{3c} - \left(-\frac{5}{3c}\right)$

## 5.3 Adding and Subtracting Unlike Fractions

**Objective:** Add or subtract unlike fractions.

### Example 1: Adding and Subtracting Fractions

Find the sum or difference.

1.  $\frac{7}{15} + \frac{1}{5}$

2.  $\frac{2}{3} - \frac{3}{4}$

### Check It Out!

Find the sum or difference.

1.  $\frac{3}{7} + \frac{5}{21}$

2.  $\frac{1}{4} - \frac{3}{10}$

### Example 2: Adding Mixed Numbers

Find the sum.

1.  $-5\frac{1}{6} + \left(-\frac{3}{10}\right)$

2.  $4\frac{5}{6} + 2\frac{4}{9}$

### Check It Out!

Find the sum.

1.  $-4\frac{2}{5} + \left(-2\frac{6}{11}\right)$

2.  $3\frac{5}{9} + 2\frac{1}{6}$

### Example 3: Subtracting Mixed Numbers

1. You are hiking a  $12\frac{1}{5}$  mile trail. You have already hiked  $6\frac{1}{2}$  miles. How many more miles do you have to hike before reaching the end of the trail?

#### Check It Out!

Find the difference.

1.  $-2\frac{1}{3} - 3\frac{3}{7}$

2.  $6\frac{7}{18} - 8\frac{21}{54}$

### Example 4: Simplifying an Expression

Simplify the expression.

1.  $\frac{a}{4} - \frac{a}{8}$

2.  $\frac{b}{3} - \frac{b}{8}$

#### Check It Out!

Simplify the expression.

1.  $\frac{c}{5} - \frac{c}{7}$

2.  $\frac{a}{2} - \frac{a}{6}$

# 5.4 Multiplying Fractions

**Objective:** Multiply fractions and mixed numbers.

<b>Multiplying Fractions</b>
<b>Words</b> The product of two or more fractions is equal to the product of the numerators over the product of the denominators.
<b>Numbers</b> $\frac{3}{5} \cdot \frac{4}{7} = \frac{\square}{\square} = \frac{\square}{\square}$
<b>Algebra</b> $\frac{a}{b} \cdot \frac{c}{d} = \frac{\square}{\square}$ , where $b \neq 0$ and $d \neq 0$

## Example 1: Multiplying Fractions

Find the product.

1.  $\frac{5}{12} \cdot \left(-\frac{3}{20}\right)$

2.  $\frac{7}{16} \cdot \frac{5}{14}$

### Check It Out!

Find the product.

1.  $\frac{2}{15} \cdot \left(-\frac{5}{18}\right)$

2.  $\frac{7}{10} \cdot \left(-\frac{4}{21}\right)$

## Example 2: Multiplying a Mixed Number and an Integer

The showerhead in your house uses  $2\frac{1}{2}$  gallons of water per minutes. If you take a 7-minute shower, how many gallons of water do you use?

### Check It Out!

Find the product.

1.  $5\frac{2}{9} \cdot 6$

2.  $2\frac{3}{4} \cdot (-12)$

### Example 3: Multiplying Mixed Numbers

Find the product.

$$1. -3\frac{1}{5} \cdot 4\frac{1}{6}$$

$$2. -2\frac{3}{4} \cdot 5\frac{1}{3}$$

### Check It Out!

Find the product.

$$1. -2\frac{3}{4} \cdot 3\frac{1}{5}$$

$$2. 4\frac{7}{8} \cdot 5\frac{2}{3}$$

### Example 4: Simplifying Expressions

Find the product.

$$1. \frac{m}{4} \cdot \left(-\frac{10}{7}\right)$$

$$2. \frac{n^4}{12} \cdot \frac{9n^2}{10}$$

### Check It Out!

Find the product.

$$1. \frac{2x}{5} \cdot \frac{3x^2}{8}$$

$$2. -\frac{4y^3}{15} \cdot \frac{5y^6}{16}$$



# 5.5 Dividing Fractions

**Objective:** Divide fractions and mixed numbers.

Two nonzero numbers whose product is 1 are \_\_\_\_\_.

## Using Reciprocals to Divide

**Words** To divide by any nonzero number, multiply by its reciprocal.

**Numbers**  $\frac{2}{9} \div \frac{3}{7} = \frac{2}{9} \cdot \frac{7}{3} = \frac{14}{27}$

**Algebra**  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$ , where  $b \neq 0$ ,  $c \neq 0$ , and  $d \neq 0$

## Example 1: Dividing a Fraction by a Fraction

Find the quotient.

1.  $-\frac{3}{7} \div \frac{6}{11}$

2.  $\frac{8}{21} \div \frac{9}{14}$

## Check It Out!

Find the quotient.

1.  $-\frac{5}{12} \div \frac{5}{24}$

2.  $-\frac{2}{5} \div \frac{4}{7}$

## Example 2: Dividing a Mixed Number by a Mixed Number

Find the quotient.

1.  $2\frac{1}{2} \div -3\frac{6}{11}$

2.  $4\frac{3}{5} \div 1\frac{7}{10}$

## Check It Out!

Find the quotient.

1.  $-3\frac{1}{4} \div 5\frac{1}{2}$

2.  $\frac{3}{8} \div 9\frac{1}{6}$

### Example 3: Dividing a Mixed Number by a Mixed Number

You have two dogs that eat about  $1\frac{1}{5}$  pounds of dog food per day. How many whole days will a 5-pound bag of dog food last?

### Check It Out!

You want to join strips of wood that are 15 inches long and  $1\frac{5}{8}$  inches wide to make a cutting board that is at least 12 inches wide. How many strips are needed?

## 5.6.5 Reasonableness of Answers

**Objective:** Assess the Reasonableness of answers by using mental math and estimation.

### Example 1: Estimating with Decimals and Fractions

Evaluate the expression. Use mental math and estimation to assess the reasonableness of your answer.

1.  $5.3 - 2 + 8.9$                       2.  $4 \frac{1}{2} - 25 - 7.25$                       3.  $8.7 + 5 \frac{1}{4} + 2.4$

### Check It Out!

Evaluate the expression. Use mental math and estimation to assess the reasonableness of your answer.

1.  $1.03 + 2 + 5.4 + 7.9$                       2.  $15.3 + 18.1 + 9$                       3.  $6.2 + 3 \frac{3}{4} - 5.9$

### Example 2: Assessing Reasonableness

1. A skit has a 1.9 minute song, a  $2 \frac{1}{4}$  minute dialoge, and a 3.2 minute song. The teacher calculates that the skit is 7 minutes and 20 seconds long. Is this reasonable? Explain.

2. You buy a sweater for \$30.99, a pair of shoes for \$46.79, a book bag for \$15.20, and a DVD for \$8.00. While in the checkout line you guess that your total bill before tax will be about \$80. Is \$80 a reasonable answer? Explain.

3. Your teacher assigns you 130 pages to read in a book over the weekend. Friday night you read  $28\frac{1}{2}$  pages, Saturday morning you read  $42\frac{3}{4}$  pages, and Saturday night you read 18 pages. You tell your pages that you only have about 40 pages left to read. Is this a reasonable estimate? Explain.

4. You have \$25 to spend in a gift shop. You choose four items with prices of \$4, \$7.79, \$16.20, and \$2.09. Is it reasonable to assume you can buy all of these items? Explain.

## 5.6 Using Multiplicative Inverses to Solve Equations

**Objective:** Use multiplicative inverses to solve equations.

The \_\_\_\_\_ of a nonzero number is the number's reciprocal.

### Multiplicative Inverse Property

**Words** The product of a number and its multiplicative inverse is 1.

**Numbers**  $\frac{3}{5} \cdot \frac{5}{3} = 1$

**Algebra**  $\frac{a}{b} \cdot \frac{b}{a} = 1$ , where  $a \neq 0, b \neq 0$

### Example 1: Solving a One-Step Equation

Solve the equation. Show your work and check your answer.

1.  $\frac{3}{5}x = 15$

2.  $\frac{6}{11}x = 18$

### Check It Out!

Solve the equation. Show your work and check your answer.

1.  $-\frac{7}{13}x = 28$

2.  $\frac{4}{7}x = -12$

### Example 2: Solving a Two-Step Equation

Solve the equation. Show your work and check your answer.

1.  $-\frac{7}{13}x + \frac{3}{4} = \frac{1}{2}$

### Check It Out!

Solve the equation. Show your work and check your answer.

1.  $-\frac{11}{15}x + \frac{4}{5} = \frac{1}{3}$

### Example 3: Writing and Solving a Two-Step Equation

The height of a certain Norway Spruce is 10 feet. If the tree's height grows  $2\frac{1}{2}$  feet per year, find how long it will take the tree to reach a height of 25 feet.

### Check It Out!

Stalactites are icicle-shaped stone formations found on cave ceilings. They form from minerals deposited by dripping water. Suppose a stalactite is 10 inches long and is growing at a rate of about  $\frac{1}{8}$  inch per decade. How long will it take for the stalactite to reach a length of 1 foot?

## 5.7 Equations and Inequalities with Rational Numbers

**Objective:** Use the LCD to solve equations and inequalities.

Another way to solve an equation with fractions is to clear fractions by multiplying each side by the LCD of the fractions. The resulting equation is equivalent to the original equation.

### Example 1: Solving an Equation by Clearing Fractions

Solve each equation by eliminating the fractions.

1.  $\frac{1}{4}x + \frac{3}{10} = \frac{2}{5}$

2.  $\frac{1}{3}x + \frac{5}{6} = \frac{7}{9}$

### Check It Out!

Solve each equation by eliminating the fractions.

3.  $\frac{3}{10} - \frac{7}{15}x = \frac{2}{3}$

4.  $-\frac{2}{9} = \frac{3}{4} - \frac{1}{6}x$

### Example 2: Solving an Inequality by Clearing Fractions

Solve each inequality by eliminating the fractions.

1.  $\frac{3}{7}x + \frac{1}{4} < \frac{1}{2}$

2.  $\frac{5}{6}x - \frac{1}{5} < -\frac{8}{15}$

**Check It Out!**

Solve each inequality by eliminating the fractions.

3.  $\frac{8}{15}x - \frac{17}{30} > \frac{7}{10}$

4.  $\frac{4}{5} > \frac{2}{3} - \frac{2}{5}x$

**Example 3: Solving an Equation by Clearing Decimals**

Solve each inequality by first clearing the decimals.

1.  $0.5m - 4.9 = 2.6$

2.  $0.2x + 5.7 = 9.3$

**Check It Out!**

Solve each inequality by first clearing the decimals.

3.  $0.55 - 0.2k = 0.15$

4.  $0.5 - 0.4p = 1.3$