Objective:

This handout will help students simplify fractions.

Vocabulary Review:

*Simplified Fraction* - a fraction whose numerator and denominator cannot be divided evenly by the same whole number. The Greatest Common Factor of the numerator and the denominator of a simplified fraction is always 1. Sometimes a simplified fraction is called a fraction “reduced” to the lowest terms.

*Equivalent Fractions* - fractions that have the same value or represent the same part of a whole, but have different denominators.

Equivalent Fractions

Every fraction can be named by an infinite number of equivalent fractions. Equivalent fractions have the same overall value even if the parts look different. All equivalent fractions represent the same part of a whole. Only one of the equivalent fractions is the simplified fraction though.

Below is an example of three equivalent fractions. Each diagram represents the same value (the shaded area), but the one with the smallest number of parts to the whole represents the fraction in simplest form.

The diagram shows that $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$. The fraction $\frac{1}{2}$ is in simplest form (reduced). It has the smallest number of parts. Notice it has the smallest denominator.
Simplify Fractions Using the Greatest Common Factor

Example 1: Simplify $\frac{16}{90}$

*Step 1 -* List the prime factors of the numerator and denominator.

$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$

$$90 = 2 \cdot 3 \cdot 3 \cdot 5$$

*Step 2 -* Cross out all the common factors in the numerator and in the denominator.

$$\frac{16}{90} = \frac{2 \cdot 2 \cdot 2}{2 \cdot 3 \cdot 3 \cdot 5}$$

In this example, 2 is the Greatest Common Factor for 16 and 90.

*Step 3 -* Multiply the remaining factors in the numerator and the denominator.

$$\frac{16}{90} = \frac{2 \cdot 2 \cdot 2}{2 \cdot 3 \cdot 3 \cdot 5} = \frac{8}{45}$$

Simplify Fractions Using Divisibility Rules

Example 2: Simplify $\frac{36}{45}$

Use the divisibility rules to find a whole number that divides evenly into the numerator and the denominator. See the module called Prime Factors and Divisibility for a review of the divisibility rules.

36 and 45 are both divisible by 1, 3, 9. If we divide the numerator and the denominator by the largest number, the answer will be in simplest form. If we divide the numerator and the denominator by 3 we will have to repeat these steps again. Dividing by 1 will never change the fraction. So the best choice is to divide the numerator and denominator by the largest number that divides evenly into both.

$$\frac{36}{45} \div \frac{9}{9} = \frac{4}{5}$$
Use your knowledge of prime factors to determine if the fraction is simplified completely. \( 4 = 2 \times 2 \) and 5 is a prime factor. Since none of the factors in the numerator match any factors in the denominator, this fraction is simplified.

Try these exercises:

Simplify the following fractions completely.

<table>
<thead>
<tr>
<th>1) ( \frac{49}{56} )</th>
<th>3) ( \frac{12}{36} )</th>
<th>5) ( \frac{45}{75} )</th>
<th>7) ( \frac{15}{50} )</th>
<th>9) ( \frac{26}{78} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) ( \frac{7}{1} )</td>
<td>4) ( \frac{125}{225} )</td>
<td>6) ( \frac{11}{0} )</td>
<td>8) ( \frac{14}{14} )</td>
<td>10) ( \frac{0}{12} )</td>
</tr>
</tbody>
</table>

Answers:

1) \( \frac{7}{8} \) 3) \( \frac{1}{3} \) 5) \( \frac{3}{5} \) 7) \( \frac{3}{10} \) 9) \( \frac{1}{3} \)

2) 7 4) \( \frac{5}{9} \) 6) undefined 8) 1 10) 0