Recall:
In the last section, we learned that \( \frac{2}{4} \) and \( \frac{1}{2} \) are equivalent fractions. In fact, \( \frac{2}{4} = \frac{1}{2} \) is in simplest form (or \( \frac{1}{2} \)).

To write fractions in simplest form, we must be able to break the numerator and denominator down into prime factors. A fraction is in simplest form when the numerator and denominator have no other common factors besides 1.

Consider \( \frac{2}{4} \). To write it in simplest form, first write 2 and 4 as a product of prime factors.

\[
\frac{2}{4} = \frac{2}{2 \cdot 2}
\]

Example 1: Simplify the following fractions.

a) \( \frac{5}{20} \)

b) \( \frac{18}{4} \)

c) \( \frac{70y}{80y} \)

d) \( \frac{45b}{80b^2} \)

e) \( \frac{60x^2y}{36xy^3} \)
 ALSO! You could think about simplifying fractions by dividing both the numerator and denominator by common factors. However, depending on what you choose to divide by, you may have to repeat this process more than once. It is best to divide by the greatest common factor.

Consider \( \frac{12}{40} \)

*Note: You can only cancel common factors.* Please note the difference between the two examples below.

\[
\frac{xy}{x} \quad \frac{x + y}{x}
\]

*Example 2:* Four out of ten marbles are red. What fraction of the marbles are *not* red?

To **multiply** fractions, you multiply the numerators and denominators separately and then simplify.

\[
\frac{a \cdot c}{b \cdot d} = \frac{a \cdot c}{b \cdot d}
\]

*Note:* You can simplify any numerator with any denominator!

It may be easier to simplify first, if possible, and then multiply!

Consider \( \frac{1}{2} \cdot \frac{2}{3} \).
Example 3: Multiply the following and simplify.

a) \(\frac{2}{15} \cdot \frac{5}{4}\)

b) \(\frac{3}{6} \cdot \frac{2}{9}\)

c) \(\frac{5}{8} \cdot \frac{1}{3}\)

d) \(\left(-\frac{1}{3}\right)^4\)

e) \(-\frac{2}{3} \cdot 6y^3\)

f) \(\frac{a \cdot 2b}{b^2 \cdot 4a^3}\)

Example 4: If you go on a motorcycle trip of 100 miles in the mountains and \(\frac{15}{16}\) of the trip is downhill, how many miles of the trip are not downhill? Reduce to lowest terms.