An NFL football game is split into 4 “quarters” of equal length. After the first quarter is complete, we say that \( \frac{1}{4} \) of the game is over. This refers to the total number of equal parts (quarters, in this case) of a whole game that have been played. When we want to represent parts of a “whole”, we can use \textbf{fractions}.

\[
\frac{1}{4} \quad \text{over}
\]

Consider a whole pizza that is cut into 6 equal pieces. If two pieces of the pizza are eaten, we say that \( \frac{2}{6} \) of the pizza is gone.

Let’s illustrate this example using a circle.

![Diagram](https://via.placeholder.com/150)

Divide the circle into 6 equal parts and shade two of them. The shaded area represents \( \frac{2}{6} \) of the whole.

\textit{Example 1:} Draw and shade a part of the diagram that represents each fraction given.

a) \( \frac{3}{5} \)

b) \( \frac{2}{3} \)

\textbf{Proper fractions:} fraction whose numerator is \underline{___________________} its denominator (the value of proper fractions are less than 1)
Consider the fraction $\frac{4}{3}$. This is called an improper fraction because the numerator is greater than or equal to the denominator. The value of improper fractions is greater than or equal to 1. They are used to represent situations in which we refer to all parts of a whole or more than a whole.

For instance, consider two pizzas of the same size that are both cut into 4 equal pieces. Six pieces have been eaten.

The improper fraction is:

Let’s illustrate this example using circles. There are 4 parts to a whole, but we are referring to 6 of these parts.

![Example of improper fraction with circles]

*Example 2:* Draw and shade a part of the diagram that represents the improper fraction $\frac{3}{3}$.

![Example of improper fraction with a shaded part]

Remember that the fraction bar is a symbol for division. If $n$ is an integer other than 0,

\[
\frac{n}{n} = \frac{0}{n} = \frac{n}{0} = 1\
\]

**Graphing Fractions on the Number Line**

To graph proper fractions on the number line, take 1 unit on the line to be a “whole”.

Consider $\frac{2}{3}$. To graph, first divide the segment between 0 and 1 into 3 equal parts. Then, count 2 parts to the right.
To graph improper fractions, take 1 unit as a “whole” but remember that an improper fraction is greater than or equal to 1.

Consider \( \frac{7}{3} \). To graph, first divide the first few segments into 3 equal parts. Then, count 7 parts to the right.

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**Equivalent Fractions**

Now consider the fraction \( \frac{2}{4} \):

Notice that when we shade in 2 parts of the 4 total, we end up actually shading _______ of the whole.

In other words, \( \frac{2}{4} = \) _______

These are called _________________________________. They represent the same part of a whole (and are at the same point when graphed on the number line).

**Fundamental Principle of Fractions:** If \( \frac{a}{b} \) is a fraction and \( c \) is a nonzero real number, then:

\[
\frac{a}{b} = \frac{a}{b} = \frac{a}{b} = \frac{a}{b} =
\]

If the numerator and denominator are multiplied or divided by the same nonzero number, you obtain an equivalent fraction.

**Example 3:** Write the following fractions as an equivalent fraction with the indicated denominator.

a) \( \frac{3}{5} \) with a denominator of 25

b) \( 6 \) with a denominator of 2

c) \( \frac{5}{3b} \) with a denominator of \( 21b \)