Adding and Subtracting Like Fractions

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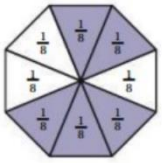
Lecture Notes

The Unit Fraction and Equal Fractional Parts

Fractions as a Partition of an Object Divided into Equal Parts

Consider a candy bar divided into 5 equal sections. If you eat 2 sections, you have eaten $\frac{2}{5}$ of the candy bar. The denominator 5 tells us the unit, $\frac{1}{5}$. The numerator 2 tells us the number of equal parts we are considering, 2.

EXAMPLE 2 What part is shaded?



There are 8 equal parts. This tells us the unit, $\frac{1}{8}$. The *denominator* is 8. We have 5 of the units shaded. This tells us the *numerator*, 5. Thus,

$\frac{5}{8}$ ← 5 units are shaded.
← The unit is $\frac{1}{8}$.

is shaded.

A **fraction** is a number divided into *equal parts*.

The **numerator** represents the *individual equal parts* of a fraction.

The **denominator** represents the *total equal parts* of a fraction.

The **unit fraction** is a fraction where the:

- Numerator is 1.
- Denominator is a *whole number*.

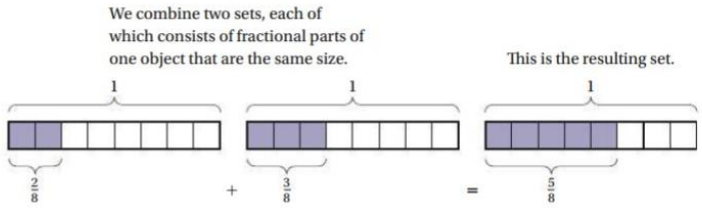
A unit fraction represents exactly 1 *part* (numerator) of all the equal parts of the *whole* (denominator).

Thus, a fraction represents the **part** over the **whole**: $\frac{Part}{Whole}$

a ADDITION USING FRACTION NOTATION

Like Denominators

Addition using fraction notation corresponds to combining or putting like things together, just as addition with whole numbers does. For example,



2 eighths + 3 eighths = 5 eighths,

or $2 \cdot \frac{1}{8} + 3 \cdot \frac{1}{8} = 5 \cdot \frac{1}{8}$, or $\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$.

We see that to add when denominators are the same, we add the numerators and keep the denominator.

We combine (**add** or **subtract**) fractions only if they have the *same* unit fraction.

This means that both fractions must have the *same* denominator.

Fractions with the same denominator are called **like denominators** (*like fractions*).

To add, simply add the two numerators (*individual equal parts*) of the fractions to obtain a sum of the *individual equal parts*.

The denominator does not change since it represents the *total equal parts* of the two.

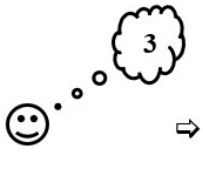
Notes

- Fractions that have the *same denominators* are called **like fractions,** because the denominators are *alike.*
- Adding and subtracting fractions with the *same denominator* is relatively easy.
    - Having the same denominators rarely happens.
    - Usually, the denominators are different.
    - We will examine different denominators later in the course.
- If you understand how to *add* fractions, you will have no problem with how to *subtract* fractions.
    - The only difference between the two is the actual addition step, or subtraction step.
    - All other steps are the same for both types of problems.

Add and Subtract Fractions with Like Denominators

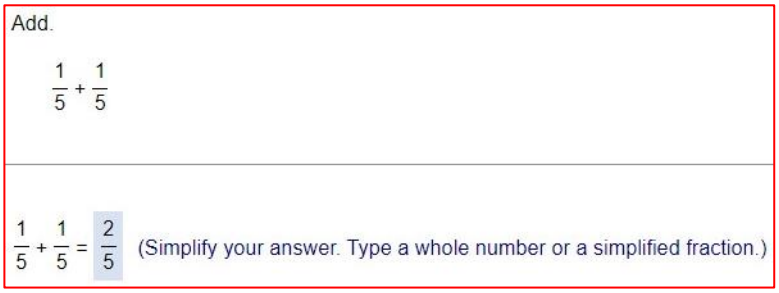
- **Step 1:** Add or subtract numerators.
- **Step 2:** Keep denominators the same.
- **Step 3:** Reduce, if possible.
- *Caution:* You **cannot "reduce up front"** while in *addition or subtraction mode*. You must wait until the end to reduce.

Example:

$\frac{5}{9} + \frac{7}{9} \Rightarrow \frac{12}{9} \Rightarrow \frac{\cancel{12}^{4}}{\cancel{9}_{3}}$ 

$\Rightarrow \frac{4}{3}$

- Add numerators.
- Keep denominators the same.
- Reduce.



- After adding numerators, we get: $\frac{2}{5}$
- Keep denominators the same.
- The last step is to reduce. However, the fraction does not reduce.

Add and simplify. $\frac{1}{12}+\frac{1}{12}$	$\frac{1}{12}+\frac{1}{12}=\frac{1}{6}$ (Simplify your answer. Type a whole number, fraction, or mixed number.)

- After adding numerators, we get: $\frac{2}{12}$
- The last step is to reduce: $\frac{1}{6}$

Add and simplify. $\begin{array}{r} \frac{7}{10} \\ +\frac{1}{10} \\ \hline \end{array}$	$\begin{array}{r} \frac{7}{10} \\ +\frac{1}{10} \\ \hline \frac{4}{5} \end{array}$ (Simplify your answer. Type a whole number, fraction, or mixed number.)

- Adding and subtracting fractions in a vertical format involves the same steps as in the horizontal format.
- For addition, changing the order of the fractions does not affect the answer because of the *Commutative Property of Addition*.
- However, for subtraction the order of the fractions *cannot* be changed. There is no ~~*Commutative Property of Subtraction*~~.

Add and simplify. $\frac{14}{22}+\frac{3}{22}+\frac{2}{22}$	$\frac{14}{22}+\frac{3}{22}+\frac{2}{22}=\frac{19}{22}$ (Type a simplified fraction.)

- When adding *three* fractions, we use the same procedure as when adding two fractions.
- After adding the three numerators, we get: $\frac{19}{22}$
- Keep denominators the same.
- The last step is to reduce. However, the fraction does not reduce.

Add. Simplify the result if possible.

$\frac{2}{5}+\frac{3}{5}$

$\frac{2}{5}+\frac{3}{5}=1$ (Type a whole number or a fraction.)

- After adding numerators, we get: $\frac{5}{5}$
- The last step is to reduce: $\frac{5}{5}=\mathbf{1}$

Subtract and simplify.	
$\frac{8}{15} - \frac{1}{15}$	$\frac{8}{15} - \frac{1}{15} = \frac{7}{15}$ (Type a whole number or a simplified fraction.)

- Subtracting two fractions involves the same steps as when adding two fractions, except that now we are *subtracting* the numerators.
- After subtracting numerators, we get: $\frac{7}{15}$
- The last step is to reduce. However, the fraction does not reduce.

Subtract and simplify.	
$\frac{31}{22}$ $-\frac{21}{22}$	$\frac{31}{22}$ $-\frac{21}{22}$ $\frac{5}{11}$ (Simplify your answer. Type a whole number, fraction, or mixed number.)

- Subtracting fractions in a vertical format involves the same steps as in the horizontal format.
- But we must keep in mind that for subtraction, the order of the fractions *cannot* be changed.
- After subtracting numerators, we get: $\frac{10}{22}$
- The last step is to reduce: $\frac{5}{11}$