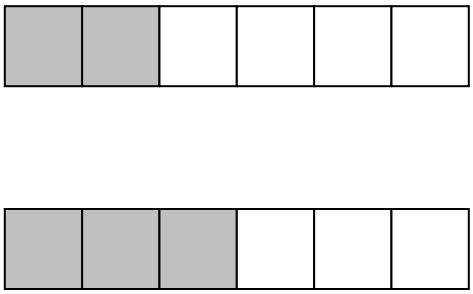
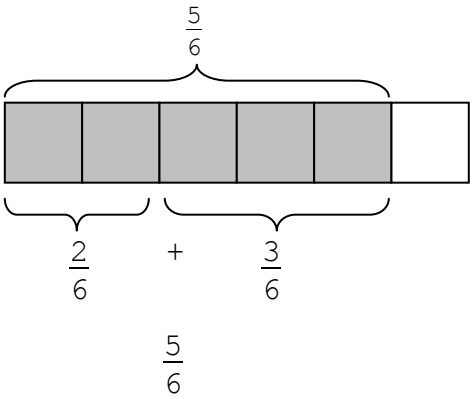
WILLIAM D. LAW, JR. LEARNING COMMONS

Adding Fractions and Mixed Numbers

I. Adding Fractions with the Same Denominator



$$\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$$



REMEMBER the **denominator** tells how many parts are in **one** rectangle. It tells us something about the **size** of the parts. The **numerator** tells **how many** of these parts are being added.

EXAMINE THE STATEMENT $\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$

NOTICE:

The denominators are the same in both addends.
The denominator of the sum is also this same number.
(Denominators are NOT ADDED.)
The numerators of the addends are added to get the numerator of the sum.
The answer **is** simplified. (1 is the only factor of 5 and of 6.)

THINK: If you add 2 dimes to 7 dimes, you'll have 9 dimes (the kind of coin can be like a denominator - we keep it; the numbers of coins are added just as numerators are).

Isn't a dime $\frac{1}{10}$ of a dollar?

2 dimes + 7 dimes is the same as

$$\frac{2}{10}\text{dollar} + \frac{7}{10}\text{dollar} = \frac{9}{10}\text{dollar}$$

Understanding the meanings of the numerator and denominator makes addition of fractions easier to understand.

1–4. ADD and SIMPLIFY the answers:

1. $\frac{4}{9}+\frac{2}{9}$ 2. $\frac{5}{8}+\frac{3}{8}$ 3. $\frac{7}{12}+\frac{4}{12}$ 4. $\frac{5}{12}+\frac{3}{12}+\frac{6}{12}$

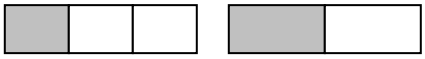
5. Write a rule for adding fractions with the same denominator.

II. Adding Fractions with Unlike Denominators

If you have 3 nickels + 4 dimes, you have 7 coins but that doesn't tell the value. To get the total value, you will probably think of 3 nickels as 15 cents and 4 dimes as 40 cents. Then you add 15 + 40 to find the value is 55 cents. A cent is $\frac{1}{100}$ dollar. (Doesn't it take 100 cents to make one dollar?)

Let's look at the addition problem.

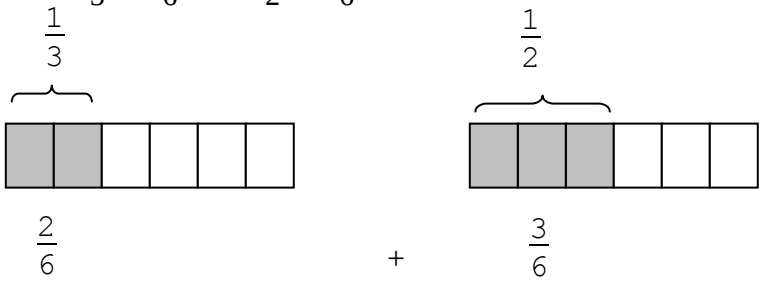
$\frac{1}{3}+\frac{1}{2}$



We have 2 parts but they are not the same size, so we don't know how much of a rectangle this sum is.

$\frac{1}{3}+\frac{1}{2}$

Let's think of $\frac{1}{3}$ as $\frac{2}{6}$ and $\frac{1}{2}$ as $\frac{3}{6}$. (Look up writing equivalent fractions in your text.)



Once the fractions have the same denominator, we know how to add them, but how do we decide what denominator we should use? We use the **LCM** of the denominators.

Complete the Rule:

To add fractions with unlike denominators:
1. Find the_____of the denominators.
2. Build_____fractions having the _____ of the denominators as the denominator of each fraction.
3. Add the_____; keep the_____of these new fractions.
4. Simplify the answer if_____.

EXAMPLE: $\frac{5}{8}+\frac{5}{6}+\frac{2}{9}$

1. Find the LCM of denominators

$8 = 2 \cdot 2 \cdot 2$
$6 = 2 \cdot 3$
$9 = 3 \cdot 3$
LCM = $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 72$

2. Build equivalent fractions

$\frac{5}{8} = \frac{45}{72}$ $\frac{5}{6} = \frac{60}{72}$ $\frac{2}{9} = \frac{16}{72}$

3. Add numerators; keep denominator

$\frac{45+60+16}{72} = \frac{121}{72}$

4. Simplify (see your text)

$1\frac{49}{72}$ (There is no common factor other than 1 in the numerator and denominator)

$1 + \frac{7 \times 7}{2 \times 2 \times 2 \times 3 \times 3}$

II. 5–7 Add and Simplify:

5. $\frac{5}{12}+\frac{7}{24}$ 6. $\frac{3}{8}+\frac{5}{6}+\frac{1}{16}+\frac{2}{3}$ 7. $\frac{2}{3}+\frac{1}{4}$

III. Adding Mixed Numbers and Fractions

We know that a mixed number is a short way of writing addition.

$5\frac{3}{8}$ is $5 + \frac{3}{8}$ and $3\frac{1}{4}$ is $3+\frac{1}{4}$

To add $5\frac{3}{8}$ and $3\frac{1}{4}$, we apply the Commutative and Associative Properties of Addition.

THINK: $5\frac{3}{8}+3\frac{1}{4}$ is $\left\{5+\frac{3}{8}\right\}+\left\{3+\frac{1}{4}\right\}$

Because this is **all addition** we can use the Commutative and Associative Properties of Addition to group the whole number addends and the fraction addends.

$$(5+3)+\left(\frac{1}{4}+\frac{3}{8}\right)$$

Now add inside each parentheses (REMEMBER the denominators of the fractions must be the same!)

$$(8)+\left(\frac{2}{8}+\frac{3}{8}\right)$$

$$8+\frac{5}{8}$$

$8\frac{5}{8}$ (Simplified form)

Sometimes the fraction is an improper fraction and must be simplified. Then the whole numbers can be added.

EXAMPLE: $5\frac{3}{4}+2\frac{5}{6}$

You may add the fractions, then add the whole numbers, then simplify.

$$(5+2)+\frac{3}{4}+\frac{5}{6}$$

$$7+\frac{9}{12}+\frac{10}{12}$$

$$7+\frac{19}{12}$$

$$7+1+\frac{7}{12}$$

$8\frac{7}{12}$

This is a shorter way to do the problem on the left. You must <u>understand</u> why this short way works!

$$\begin{array}{rcl} 5\frac{3}{4} & = & 5\frac{9}{12} \\ +\ 2\frac{5}{6} & = & 2\frac{10}{12} \\ \hline & & 7\frac{19}{12} \end{array}$$

III. 8–11 Add and Simplify:

8. $3\frac{5}{6}+8\frac{1}{2}+2\frac{2}{3}$

9. $6\frac{3}{4}+4\frac{1}{2}$

III. 8–11. Add and Simplify (continued):

10. $9\frac{15}{16} + 5\frac{7}{12}$ 11. $8\frac{2}{5} + 3 + 6\frac{1}{4}$

12. Tell how to add mixed numbers. Include the rules for the fraction parts and simplifying answers.

ANSWERS:

I.

1. $\frac{6}{9} = \frac{2}{3}$ 2. $\frac{8}{8} = 1$ 3. $\frac{11}{12}$

4. $\frac{14}{12} = 1\frac{1}{6}$

5. Add the numerators; keep the denominator. Write the answer in simplest form.

II. Rule for Adding Fractions:

1. LCM
2. Equivalent, LCM
3. Numerators, denominator
4. There is a common factor and/or if it is an improper fraction.

5. $\frac{17}{24}$ 6. $1\frac{15}{16}$ 7. $\frac{11}{12}$

III.

8. 15 9. $11\frac{1}{4}$ 10. $15\frac{25}{48}$ 11. $17\frac{13}{20}$

12. Add the fractions (be sure to build equivalent fractions so that the denominators are all the same). Add the whole numbers. If the fraction is an improper fraction, write it as a mixed number, then add its whole number to the whole number part of the answer. Get rid of common factors in the fractions' numerator and denominator.