

Adding and Subtracting Fractions: math lesson, Grade 4 – download the PDF

Pizza night, a recipe, a hike: fractions are everywhere! In this chapter you will break fractions into pieces, add them, subtract them, work with mixed numbers, and even multiply a fraction by a whole number. All the fractions you add or subtract here share the same bottom number, so the rules stay simple.

1. Decomposing fractions

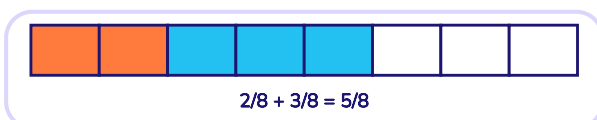
To **decompose** a fraction means to break it into a sum of smaller fractions that have the same denominator. Every fraction is made of copies of a **unit fraction**, a fraction whose numerator is 1.

D Unit fraction

A unit fraction such as $\frac{1}{8}$ is one part of a whole cut into equal parts. A fraction $\frac{5}{8}$ is five copies of $\frac{1}{8}$:

$$\frac{5}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 5 \times \frac{1}{8}$$

There are many ways to decompose the same fraction. The bar below shows $\frac{5}{8}$ as $\frac{2}{8} + \frac{3}{8}$.



E**Example 1**

Decompose $\frac{7}{10}$ in two different ways.

$\frac{7}{10} = \frac{3}{10} + \frac{4}{10}$ and also $\frac{7}{10} = \frac{5}{10} + \frac{2}{10}$. The numerators add up to 7 and the denominator stays 10.

2. Adding fractions with like denominators

Fractions with **like denominators** are cut into the same size of parts, so you can simply count the parts.

P**Adding like fractions**

Add the numerators and keep the denominator:

$$\frac{a}{d} + \frac{b}{d} = \frac{a+b}{d}$$

E**Example 2**

Mia ran $\frac{3}{10}$ of a mile, then walked $\frac{4}{10}$ of a mile. How far did she go?

$\frac{3}{10} + \frac{4}{10} = \frac{7}{10}$. Mia went $\frac{7}{10}$ of a mile.



Common mistake

Never add the denominators! $\frac{3}{10} + \frac{4}{10}$ is **not** $\frac{7}{20}$. The parts are still tenths, so the denominator stays 10.

If the sum reaches the denominator, you have a whole: $\frac{6}{6} = 1$. For example $\frac{2}{6} + \frac{4}{6} = \frac{6}{6} = 1$.

3. Subtracting fractions with like denominators

Subtracting works the same way: you take parts away, and the size of the parts does not change.



Subtracting like fractions

Subtract the numerators and keep the denominator:

$$\frac{a}{d} - \frac{b}{d} = \frac{a - b}{d} \quad (a \geq b)$$



$$7/8 - 3/8 = 4/8 \text{ (3 parts taken away)}$$



Example 3

A jug holds $\frac{9}{12}$ of a gallon of juice. You pour out $\frac{5}{12}$ of a gallon. How much is left?

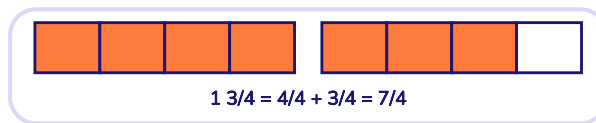
$$\frac{9}{12} - \frac{5}{12} = \frac{4}{12} \text{ of a gallon is left.}$$

To subtract a fraction from 1, write 1 as a fraction with the same denominator:

$$1 - \frac{3}{8} = \frac{8}{8} - \frac{3}{8} = \frac{5}{8}.$$

4. Mixed numbers and improper fractions

A **mixed number** has a whole number part and a fraction part, like $1\frac{3}{4}$. An **improper fraction** has a numerator greater than or equal to its denominator, like $\frac{7}{4}$. They are two ways to write the same amount.

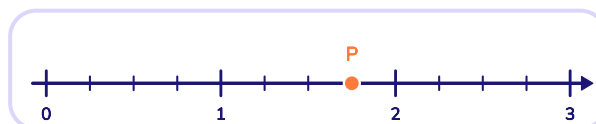


M

Converting

1. **Mixed number to improper fraction:** multiply the whole number by the denominator, add the numerator, keep the denominator. For $2\frac{3}{5}$: $2 \times 5 + 3 = 13$, so $\frac{13}{5}$.
2. **Improper fraction to mixed number:** divide the numerator by the denominator. The quotient is the whole number and the remainder is the new numerator. For $\frac{11}{4}$: $11 \div 4 = 2$ remainder 3, so $2\frac{3}{4}$.

The number line shows that $\frac{7}{4}$ sits between 1 and 2, exactly three fourths of the way past 1.



E**Example 4**

Write $\frac{17}{6}$ as a mixed number. $17 \div 6 = 2$ remainder 5, so $\frac{17}{6} = 2\frac{5}{6}$.

5. Adding and subtracting mixed numbers

Handle the whole numbers and the fractions separately, then put them back together.

M**Adding mixed numbers**

1. Add the whole numbers.
2. Add the fractions.
3. If the fraction sum is an improper fraction, convert it and add its whole part to the total.

E**Example 5**

$2\frac{5}{8} + 1\frac{6}{8}$: wholes $2 + 1 = 3$; fractions $\frac{5}{8} + \frac{6}{8} = \frac{11}{8} = 1\frac{3}{8}$. Total: $3 + 1\frac{3}{8} = 4\frac{3}{8}$.

To subtract, subtract the wholes and the fractions. If the first fraction is too small, **regroup**: borrow 1 whole and rewrite it as a fraction.

E**Example 6**

$5\frac{1}{5} - 2\frac{3}{5}$: $\frac{1}{5}$ is smaller than $\frac{3}{5}$, so write $5\frac{1}{5} = 4\frac{6}{5}$. Then $4\frac{6}{5} - 2\frac{3}{5} = 2\frac{3}{5}$.

Check by converting: $\frac{26}{5} - \frac{13}{5} = \frac{13}{5} = 2\frac{3}{5}$.

!**Zyro's tip**

On my planet we always check subtraction by adding back. If $2\frac{3}{5} + 2\frac{3}{5}$ does not give $5\frac{1}{5}$ again, something is off. Try it!

6. Multiplying a fraction by a whole number

Multiplying a fraction by a whole number is repeated addition. Three groups of $\frac{2}{5}$ is $\frac{2}{5} + \frac{2}{5} + \frac{2}{5}$.



$$3 \times \frac{2}{5} = \frac{6}{5} = 1\frac{1}{5}$$

P**Whole number times a fraction**

Multiply the whole number by the numerator and keep the denominator:

$$n \times \frac{a}{d} = \frac{n \times a}{d}$$

E Example 7

$$4 \times \frac{3}{8} = \frac{12}{8} = 1\frac{4}{8}.$$

7. Fraction word problems

M Solving a word problem

1. Read it and decide: are you joining parts, taking parts away, or repeating the same amount?
2. Write the number sentence.
3. Compute, convert to a mixed number if you like, and answer with a full sentence and a unit.

E Example 8

A baker uses $\frac{3}{4}$ cup of sugar for one batch of cookies. How much sugar does she need for 5 batches?

$$5 \times \frac{3}{4} = \frac{15}{4} = 3\frac{3}{4}. \text{ She needs } 3\frac{3}{4} \text{ cups of sugar.}$$

Key takeaways

- A fraction is a sum of unit fractions: $\frac{5}{8} = 5 \times \frac{1}{8}$.
- With like denominators, add or subtract the numerators and keep the denominator.
- Never add the denominators.
- Convert between improper fractions and mixed numbers with division and with multiplication.
- For mixed numbers, work on the wholes and the fractions, and regroup when needed.
- $n \times \frac{a}{d} = \frac{n \times a}{d}$.
- In word problems, write a number sentence and answer with a unit.



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