Lesson - Adding, subtracting and multiplying fractions

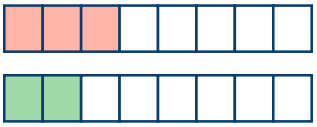
Year: Year 5

Hello, I am Otto! You can already add and subtract whole numbers, so adding and subtracting fractions is the next step. The big idea is that you can only add or subtract pieces that are the same size. In this chapter you add and subtract fractions and mixed numbers, and you multiply fractions by whole numbers. These skills help when you cook, build and share.

Starter activity

Take a chocolate bar with 8 squares. You eat 3 squares and your friend eats 2 squares. Altogether you have eaten 5 squares out of 8, which is five eighths. Did the size of the pieces change? No! We just counted how many eighths there were. Now think about what would happen if you ate 1 half and 1 quarter. The pieces are not the same size, so you need to change them first.

Adding and subtracting fractions with the same denominator



The first bar shows $\frac{3}{8}$ and the second bar shows $\frac{2}{8}$. Together there are $\frac{5}{8}$ of a bar.

Rule: same denominator

When the denominators are the **same**, add or subtract the **numerators** and keep the denominator. The denominator tells you the size of the pieces, and the size does not change. So $\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$ and $\frac{7}{10} - \frac{3}{10} = \frac{4}{10} = \frac{2}{5}$.

Watch out

Never add the denominators! $\frac{1}{5} + \frac{2}{5}$ is $\frac{3}{5}$, not $\frac{3}{10}$. Adding fifths to fifths gives more fifths, not smaller pieces called tenths.

Example 1

Work out $\frac{5}{6} + \frac{4}{6}$ and give the answer as a mixed number.

5 + 4 = 9, so the sum is $\frac{9}{6}$. This is an improper fraction. 9 ÷ 6 = 1 remainder 3, so $\frac{9}{6} = 1\frac{3}{6} = 1\frac{1}{2}$ after simplifying.

Fractions with different denominators

Method: adding or subtracting with different denominators

1. Find a common denominator. In Year 5 one denominator is usually a multiple of the other, so use the bigger one.
2. Change each fraction to an equivalent fraction with the common denominator.
3. Add or subtract the numerators and keep the denominator.
4. Simplify the answer and change an improper fraction to a mixed number.

Example 2

Work out $\frac{3}{4} + \frac{5}{8}$.

The common denominator is 8, because 4 goes into 8. $\frac{3}{4} = \frac{6}{8}$. Now $\frac{6}{8} + \frac{5}{8} = \frac{11}{8} = 1\frac{3}{8}$.

Example 3

Work out $\frac{5}{6} - \frac{1}{3}$.

The common denominator is 6, because 3 goes into 6. $\frac{1}{3} = \frac{2}{6}$. Now $\frac{5}{6} - \frac{2}{6} = \frac{3}{6} = \frac{1}{2}$.

Adding and subtracting mixed numbers

Method: adding mixed numbers

1. Add the whole numbers.
2. Add the fractions (change to a common denominator first).
3. If the fraction part is an improper fraction, change it to a mixed number and add the extra whole number to the answer.

Example 4

Work out $2\frac{3}{5} + 1\frac{4}{5}$.

Whole numbers: 2 + 1 = 3. Fractions: $\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$. Add: $3 + 1\frac{2}{5} = 4\frac{2}{5}$.

Method: subtracting mixed numbers

1. If the fraction in the first number is smaller, "borrow" one whole and change it into fractions of the right size.
2. Subtract the fractions, then subtract the whole numbers.
3. Check by adding your answer to the number you subtracted.

Example 5

Work out $5\frac{1}{2} - 2\frac{3}{4}$.

Write $5\frac{1}{2}$ as $5\frac{2}{4}$. The fraction $\frac{2}{4}$ is smaller than $\frac{3}{4}$, so borrow 1 from the 5: $5\frac{2}{4} = 4\frac{6}{4}$. Now $4\frac{6}{4} - 2\frac{3}{4} = 2$ and $\frac{3}{4} = 2\frac{3}{4}$. Check: $2\frac{3}{4} + 2\frac{3}{4} = 5$ and $\frac{6}{4} = 5\frac{1}{2}$. ✓

Multiplying fractions by whole numbers

Rule: fraction × whole number

To multiply a fraction by a whole number, multiply the **numerator** by the whole number and keep the denominator. This is repeated addition: $3 \times \frac{2}{5} = \frac{2}{5} + \frac{2}{5} + \frac{2}{5} = \frac{6}{5} = 1\frac{1}{5}$. Change an improper answer into a mixed number.

Example 6

Work out $4 \times \frac{3}{8}$.

$4 \times 3 = 12$, so the answer is $\frac{12}{8}$. Divide top and bottom by 4: $\frac{3}{2} = 1\frac{1}{2}$.

Method: mixed number × whole number

1. Multiply the whole number part by the whole number.
2. Multiply the fraction part by the whole number (and change to a mixed number if needed).
3. Add the two answers.

Example 7

Work out $3 \times 2\frac{1}{4}$.

$3 \times 2 = 6$. $3 \times \frac{1}{4} = \frac{3}{4}$. Add: $6 + \frac{3}{4} = 6\frac{3}{4}$.

Fraction of an amount

To find a fraction of an amount, divide by the denominator and multiply by the numerator. For example $\frac{3}{4}$ of 20 is $20 \div 4 = 5$ and then $5 \times 3 = 15$. This is the same as multiplying $\frac{3}{4}$ by 20.

Did you know?

The ancient Babylonians counted in sixties, and that is why we still have 60 minutes in an hour. They liked fractions with denominator 60 because 60 can be divided by 2, 3, 4, 5, 6, 10, 12, 15, 20 and 30. That makes lots of fractions easy to add!

Otto's tip

Before you add or subtract, always look at the denominators. Are they the same? If not, can you change one to match the other? When you have finished, ask: can my answer be simplified, or written as a mixed number?