

Dividing Fractions with Models and Reciprocals

Grade 6 math · Lesson · Standards: 6.NS.A.1

Quick answer: To divide by a fraction, multiply by its reciprocal, which is the fraction flipped over. Fraction division answers how many groups fit or how big one group is. Visual models show why it works, and mixed numbers become improper fractions before dividing.

Standards: 6.NS.A.1 · **Level:** Grade 6

What does it mean to divide by a fraction?

Dividing asks how many groups fit, or how big one group is. In $3 \div \frac{1}{4}$, the question is how many quarter-cup scoops fit into 3 cups.



12 quarters in 3 cups: $3 \div \frac{1}{4} = 12$

Each cup holds 4 quarter-cup pieces.

Each cup holds 4 quarters, so 3 cups hold $3 \times 4 = 12$ quarters. Dividing by $\frac{1}{4}$ gave the same result as multiplying by 4.

What is a reciprocal?

Reciprocal

Two numbers are **reciprocals** when their product is 1. Swap the numerator and denominator: the reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$, and the reciprocal of 5 (which is $\frac{5}{1}$) is $\frac{1}{5}$.

How do you divide one fraction by another?

Division rule

To divide by a fraction, multiply by its reciprocal.

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

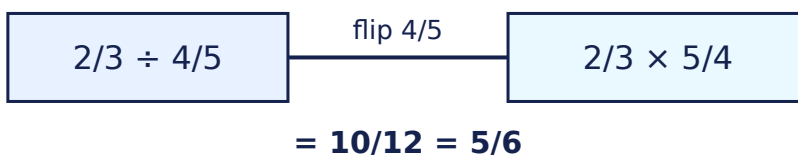
Method

1. Rewrite any mixed numbers or whole numbers as fractions.
2. Keep the first fraction and flip the second.
3. Multiply, then simplify.
4. Check by multiplying the answer by the divisor.

Worked example

Find $\frac{2}{3} \div \frac{4}{5}$.

$$\frac{2}{3} \times \frac{5}{4} = \frac{10}{12} = \frac{5}{6}.$$



Divide by a fraction by multiplying by its reciprocal.

How do you divide mixed numbers?

Change each mixed number to an improper fraction first. For $2\frac{1}{2} \div \frac{3}{4}$, write $\frac{5}{2} \times \frac{4}{3} = \frac{20}{6} = 3\frac{1}{3}$.

2 1/2 cups as 10 quarter-cup pieces



2 1/2 ÷ 3/4: 3 full groups and 1 quarter left over

The leftover quarter is 1/3 of a group of 3 quarters.

Dividing a whole number by a fraction below 1 gives a larger number, because many small groups fit. This is the opposite of dividing by a whole number, which makes the result smaller. A quick estimate before you calculate catches most flipping errors.

What are the two kinds of word problems?

In a how-many-groups problem you know the size of each group and want the number of groups, such as the number of scoops in a bag of rice. In a how-much-in-one-group problem you know the number of groups and want the size of one, such as the share of pizza each friend gets. Both are divisions, and a picture or tape diagram shows which is which.

Common mistake

Flipping the wrong fraction. Only the divisor (the second fraction) is flipped. Writing $\frac{2}{3} \div \frac{1}{4}$ as $\frac{3}{2} \times \frac{1}{4}$ gives the wrong answer.

Mathbot's tip

Make a quick estimate: dividing by a fraction less than 1 must give a bigger number than you started with.

Key points to remember

- Reciprocals multiply to 1: $\frac{3}{4}$ and $\frac{4}{3}$.
- $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$.
- Dividing by a fraction less than 1 gives a larger number.
- Turn mixed numbers into improper fractions first.
- Check a quotient by multiplying it by the divisor.

Dividing Fractions with Models and Reciprocals: frequently asked questions

What is a reciprocal?

A reciprocal is the number that multiplies with another to make 1. You find it by swapping the numerator and denominator, so the reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$.

Why does dividing by a fraction make the answer bigger?

A fraction less than 1 is a small group, so many of those groups fit into the amount. In $3 \div \frac{1}{4}$ there are 12 quarter-cup scoops in 3 cups.

How do you divide mixed numbers?

Write each mixed number as an improper fraction, flip the second one, and multiply. Then simplify and, if needed, write the answer as a mixed number.

How do you divide a fraction by a whole number?

Write the whole number as a fraction over 1 and multiply by its reciprocal. For example, $\frac{3}{4} \div 6 = \frac{3}{4} \times \frac{1}{6} = \frac{1}{8}$.

How can you check a fraction division answer?

Multiply the quotient by the divisor. If $\frac{2}{3} \div \frac{4}{5} = \frac{5}{6}$, then $\frac{5}{6} \times \frac{4}{5}$ must equal $\frac{2}{3}$.