

Dividing Fractions: math lesson, Grade 6 – download the PDF

How many $\frac{1}{4}$ -cup scoops fit in 3 cups of flour? How much does each friend get when $\frac{2}{3}$ of a pizza is shared by two people? Both questions are division with fractions. In this chapter you will use pictures, number lines and one simple rule to answer them quickly and to explain why the answers make sense.

1. What does dividing mean?

Division answers one of two questions. It can ask **how many groups** of a given size fit in an amount (measurement division), or it can ask **how big each group is** when an amount is shared equally (sharing division). Both ideas keep working when fractions are involved.

D Definition

$a \div b$ is the number that you multiply by b to get a . So $12 \div 3 = 4$ because $4 \times 3 = 12$, and $3 \div \frac{1}{4} = 12$ because $12 \times \frac{1}{4} = 3$.

The second equation is the key to checking every answer in this chapter: **quotient $\times$ divisor = dividend**.

2. Dividing a whole number by a fraction

To compute $3 \div \frac{1}{4}$, ask: how many quarters are in 3 wholes? Each whole holds 4 quarters, so three wholes hold $3 \times 4 = 12$ quarters.



$3 \div \frac{1}{4}$: each whole is cut into 4 quarters, so there are 12 quarters

E Example 1

A trail runner drinks $\frac{1}{3}$ liter of water at each rest stop. How many stops can she make with 5 liters?

Each liter gives 3 thirds, so $5 \div \frac{1}{3} = 5 \times 3 = 15$. She can make 15 stops.



Watch out

Dividing by a fraction less than 1 makes the answer **bigger**, not smaller. A common mistake is to write $3 \div \frac{1}{4} = \frac{3}{4}$. Check: $\frac{3}{4} \times \frac{1}{4}$ is nowhere near 3.

3. Dividing a fraction by a whole number

Now share instead of counting. Two thirds of a bar split into 2 equal shares gives one third in each share.

$\frac{2}{3}$  $\div 2$  $\frac{2}{3} \div 2$: two thirds shared into 2 equal parts gives $\frac{1}{3}$ each**P****Property**

Dividing by a whole number n (not 0) is the same as taking one n th of the amount:

$$\frac{a}{b} \div n = \frac{a}{b} \times \frac{1}{n} = \frac{a}{b \times n}$$

E**Example 2**

Four fifths of a poster board is cut into 2 equal strips. How much of the board is each strip?

$$\frac{4}{5} \div 2 = \frac{4}{5} \times \frac{1}{2} = \frac{4}{10} = \frac{2}{5}. \text{ Each strip is } \frac{2}{5} \text{ of the board.}$$

When the numerator is divisible by n , you can shortcut: $\frac{6}{7} \div 3 = \frac{2}{7}$, because 6 sevenths shared in 3 groups is 2 sevenths per group.

4. Reciprocals**D****Reciprocal**

Two numbers are **reciprocals** if their product is 1. To find the reciprocal of a fraction, swap its numerator and denominator. A whole number n is $\frac{n}{1}$, so its reciprocal is $\frac{1}{n}$.

Number	Reciprocal	Product
$\frac{3}{5}$	$\frac{5}{3}$	$\frac{3}{5} \times \frac{5}{3} = 1$
7	$\frac{1}{7}$	$7 \times \frac{1}{7} = 1$
$\frac{1}{9}$	9	$\frac{1}{9} \times 9 = 1$
$1\frac{1}{2} = \frac{3}{2}$	$\frac{2}{3}$	$\frac{3}{2} \times \frac{2}{3} = 1$

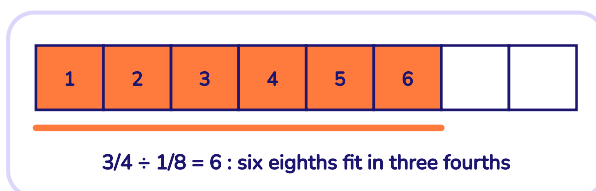


Watch out

Zero has no reciprocal, because no number multiplied by 0 gives 1. Also, change a mixed number into an improper fraction *before* flipping it.

5. Dividing a fraction by a fraction

Take $\frac{3}{4} \div \frac{1}{8}$. Three fourths is the same as six eighths, and six eighths contains 6 pieces of size one eighth. So the quotient is 6.



Notice what happened: $\frac{3}{4} \times 8 = 6$, and multiplying by 8 is the same as multiplying by the reciprocal of $\frac{1}{8}$. This works for every fraction.

M**Method: dividing by a fraction**

1. Keep the first number as it is (turn mixed numbers into fractions).
2. Change the division sign into multiplication.
3. Flip the second number to its reciprocal.
4. Multiply the numerators, multiply the denominators, then simplify.

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

E**Example 3**

Compute $\frac{2}{3} \div \frac{4}{9}$.

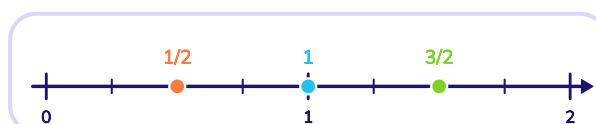
$$\frac{2}{3} \div \frac{4}{9} = \frac{2}{3} \times \frac{9}{4} = \frac{18}{12} = \frac{3}{2}. \text{ Check: } \frac{3}{2} \times \frac{4}{9} = \frac{12}{18} = \frac{2}{3}. \text{ It works.}$$

The same rule covers a whole number divided by a fraction: $6 \div \frac{3}{4} = 6 \times \frac{4}{3} = 8$.

6. Interpreting quotients

Before computing, predict the size of the answer. It saves you from silly mistakes.

- If the divisor is **less than 1**, the quotient is **greater** than the dividend ($5 \div \frac{1}{2} = 10$).
- If the divisor is **equal to 1**, the quotient equals the dividend.
- If the divisor is **greater than 1**, the quotient is **smaller** than the dividend ($\frac{3}{4} \div 3 = \frac{1}{4}$).



On the number line, $\frac{3}{2} \div \frac{1}{2}$ asks how many jumps of one half it takes to travel from 0 to $\frac{3}{2}$. The answer is 3 jumps.



Zyro's tip

On my planet we always do the “multiply back” test: if quotient $\times$ divisor does not give the dividend, the answer is wrong. It takes five seconds!

7. Word problems with fraction division

To decide whether to divide, ask yourself: am I cutting an amount into pieces of a known size, or sharing an amount equally? If yes, divide. Name the unit in your final sentence.



Method: solving a word problem

1. Identify the total amount and the size of one piece (or the number of shares).
2. Write the division sentence with the total first.
3. Compute with the reciprocal and simplify.
4. Check by multiplying back, then answer in a full sentence with units.



Example 4

A cafeteria has $4\frac{1}{2}$ gallons of juice. Each jug holds $\frac{3}{4}$ gallon. How many jugs can be filled?

$$4\frac{1}{2} \div \frac{3}{4} = \frac{9}{2} \times \frac{4}{3} = \frac{36}{6} = 6. \text{ Six jugs can be filled. Check: } 6 \times \frac{3}{4} = \frac{18}{4} = 4\frac{1}{2}.$$

E**Example 5**

A piece of cheese weighs $\frac{5}{8}$ pound and is split equally onto 5 sandwiches. What is the weight on each sandwich?

$\frac{5}{8} \div 5 = \frac{5}{8} \times \frac{1}{5} = \frac{1}{8}$. Each sandwich gets $\frac{1}{8}$ pound, which is 2 ounces.

Units can help you: pieces $\frac{3}{4}$ foot long are 9 inches long, and pieces $\frac{1}{4}$ meter long are 25 centimeters long.

Key takeaways

- Dividing by a number less than 1 gives a quotient larger than the dividend.
- $n \div \frac{1}{k} = n \times k$: count how many pieces of size $\frac{1}{k}$ fit.
- $\frac{a}{b} \div n = \frac{a}{b \times n}$ when you share by a whole number n .
- Reciprocals multiply to 1. Zero has no reciprocal.
- $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$. Keep, change, flip, then simplify.
- Always check with quotient $\times$ divisor = dividend and answer with units.

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