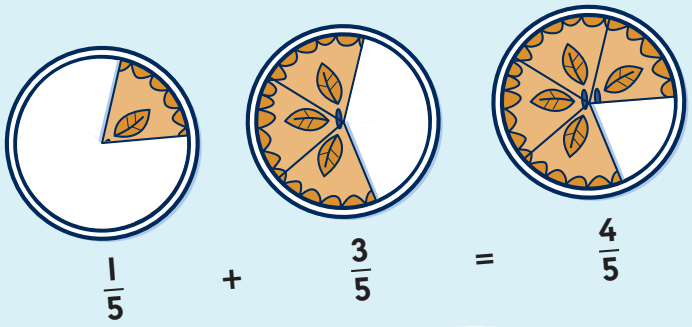
$\frac{2}{5}$ has become $\frac{8}{20}$



$\frac{1}{4}$ has become $\frac{5}{20}$

Maths in School

Fraction Calculations in School

by Kate Robinson

Oxford OWL www.oxfordowl.co.uk

OXFORD

Fractions Calculations in School

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Fractions Calculations in School

Introduction

Once children are confident using fractions they can begin to calculate with them. In this booklet, you'll find out how your child is taught to calculate with fractions in school. You'll also find a wide range of games and activities that you can use at home to build your child's skills and confidence in calculating with fractions.

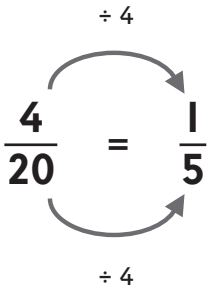
Simplifying fractions (cancelling down)

When your child starts to calculate with fractions, they'll find that it's simpler to use a fraction when the denominator is as small as possible.

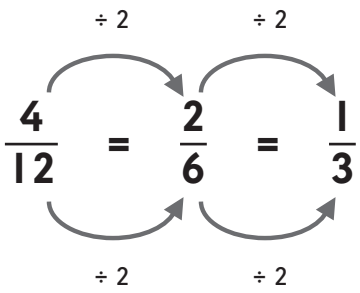
It is easier to find $\frac{1}{2}$ than $\frac{2}{4}$.

We can simplify $\frac{2}{4}$ to $\frac{1}{2}$ to make it easier to use. This is sometimes called cancelling down.

Simplifying a fraction means finding the equivalent fraction with the smallest denominator. We do it by finding the biggest number that we can divide both the numerator and denominator by:



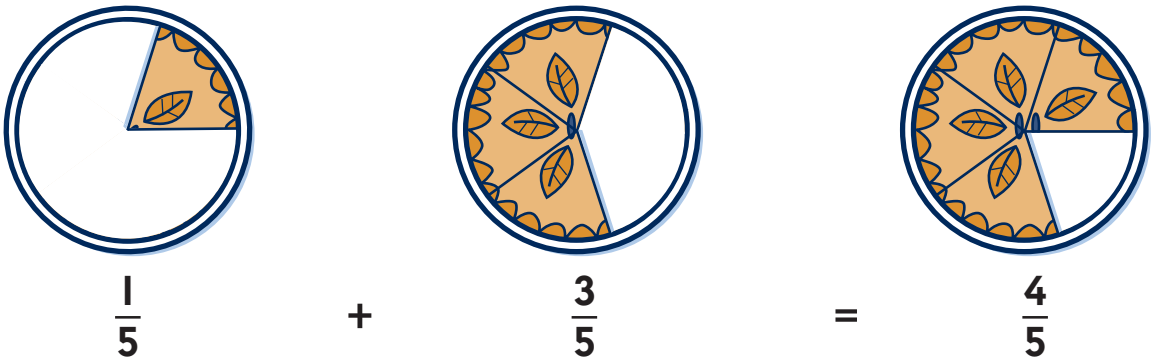
Sometimes, when we haven't divided by the biggest possible number to begin with, we need to do it again:



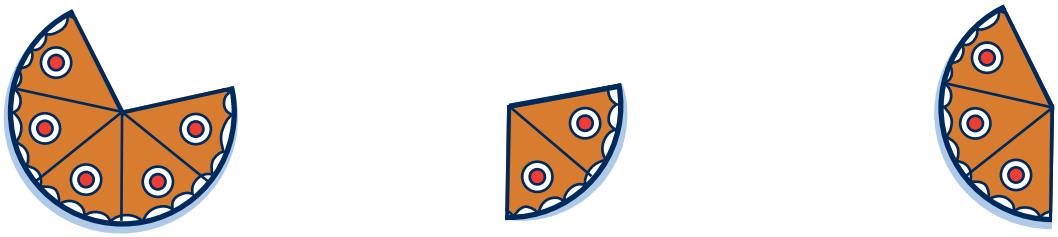
Adding and subtracting fractions

Children begin to calculate with fractions by learning to add and subtract fractions with the same denominator, where the answer comes to less than one whole thing.

All they have to do is add, or subtract, the numerators:



$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$



$\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$

Sometimes the answer to a fraction addition or subtraction needs to be ***simplified*** (as explained on page 3):

$\frac{1}{8} + \frac{3}{8} = \frac{4}{8} = \frac{1}{2}$

You can:

- *Help your child to add and subtract with the pizza fractions on page 21. Make sure they only use slices from one pizza in any one calculation. Can they name the fractions they start with and the fraction in the answer?*
- *Ask your child to practise adding and subtracting fractions when you share any sort of food that you cut into equal slices. You can ask questions like:*

  'What fraction of the pizza have you had? What fraction have I had? How much have you and I had altogether?'

Adding fractions with different denominators

Children then learn how to add and subtract fractions with different denominators:

$\frac{2}{5}$ + $\frac{1}{4}$

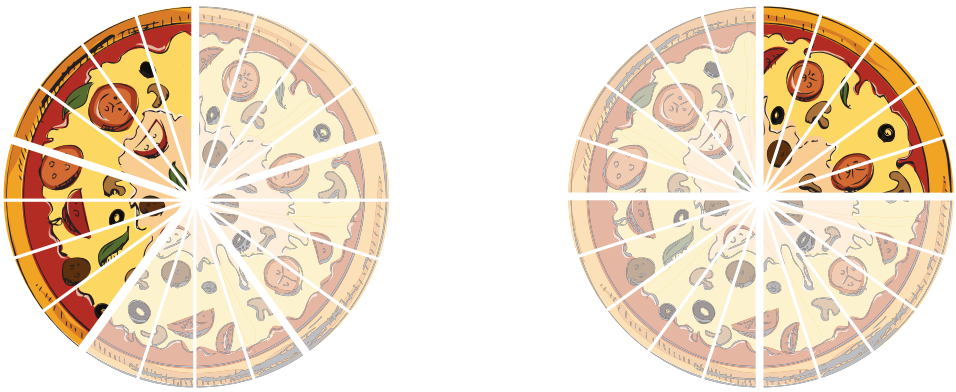
Fractions with different denominators represent different sized parts of something: one of these fifths is smaller than the one quarter.

Before we can add together these pizza fractions they have to be the same type of fraction: we have to cut them into slices of the same size.

There's a mathematical way of working out how to do this: We take the two denominators, in this case **5** and **4**, and find the smallest number that can be divided by both of them – the smallest number that's in both of their times tables. (This is known as the **L**owest **C**ommon **M**ultiple, or **LCM**, of 5 and 4.)

The smallest number that's in both the **4** and **5** times tables – their **LCM** – is **20.**

This tells us that a pizza that's already been split into quarters and a pizza that's already been split into fifths can both still be split into twentieths:



We can see that:

$\frac{2}{5}$ has become $\frac{8}{20}$ *and* $\frac{1}{4}$ has become $\frac{5}{20}$

Without a real pizza or a picture to help us, we can work out how many twentieths these fractions make like this:

Find what number we have to multiply each denominator by to turn it into the LCM. Then multiply the numerator by the same number:

$\frac{2}{5} = \frac{8}{20}$ (× 4 above, × 4 below)

$\frac{1}{4} = \frac{5}{20}$ (× 5 above, × 5 below)

To turn 5 into 20 we must multiply by 4.

So we multiply 2 by 4, which gives us 8.

To turn 4 into 20 we must multiply by 5.

So we multiply 1 by 5, which gives us 5.

We now have two fractions with the same denominator – two pizzas with the same size slices, and we can now add them together just by adding the numerators:

$$\frac{8}{20} + \frac{5}{20} = \frac{13}{20}$$

So,

$$\frac{2}{5} + \frac{1}{4} = \frac{13}{20}$$

You can:

- *Cut out the pizza fractions on page 21. Group the pizzas that are cut into halves, quarters and eighths together, those in thirds and sixths together and those in fifths and tenths together. Choose a group and show an addition calculation, such as $\frac{2}{3}$ of pizza plus $\frac{1}{6}$ of pizza, to your child. Can they use the method above to help them add the fractions and then demonstrate the calculation by cutting, or drawing on, the pizza slices?*

Subtracting fractions with different denominators

We subtract fractions with different denominators in exactly the same way as above. We find the Lowest Common Multiple of the two denominators and then change both fractions accordingly (see Adding fractions with different denominators on page 5 for a detailed explanation):

$$\frac{2}{5} - \frac{1}{4}$$

The LCM of 5 and 4 is **20**

We then take the two new fractions with the same denominators and subtract one numerator away from the other:

$$\frac{8}{20} - \frac{5}{20} = \frac{3}{20}$$

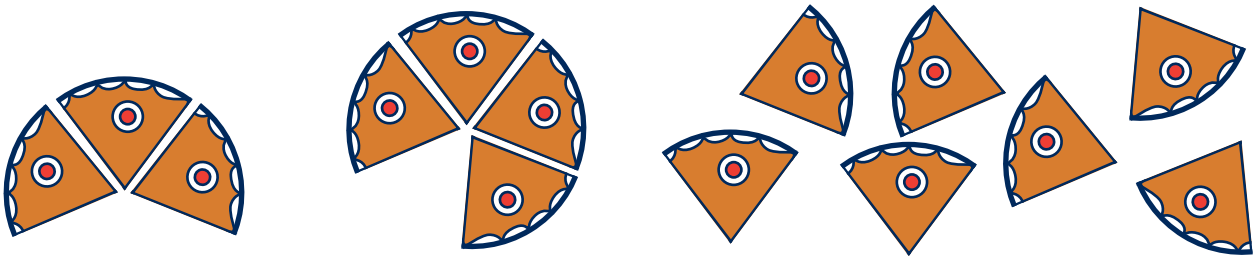
So,

$$\frac{2}{5} - \frac{1}{4} = \frac{3}{20}$$

Fraction calculations with a total above one whole

Sometimes, a fraction calculation will have an answer of more than one whole thing.

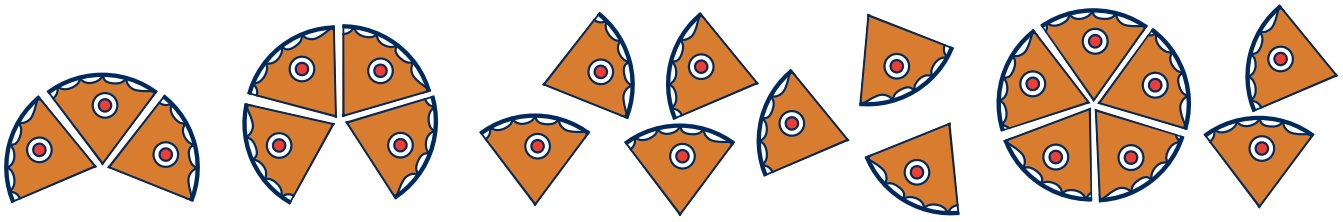
Look at this example here:



$\frac{3}{5} + \frac{4}{5} = \frac{7}{5}$

Even without the picture, we know that the answer comes to more than 1 whole cake because the answer is an ***improper fraction*** – the numerator is higher than the denominator. If the answer to a fraction calculation is more than 1, we need to turn the answer from an improper fraction to a mixed fraction.

So:



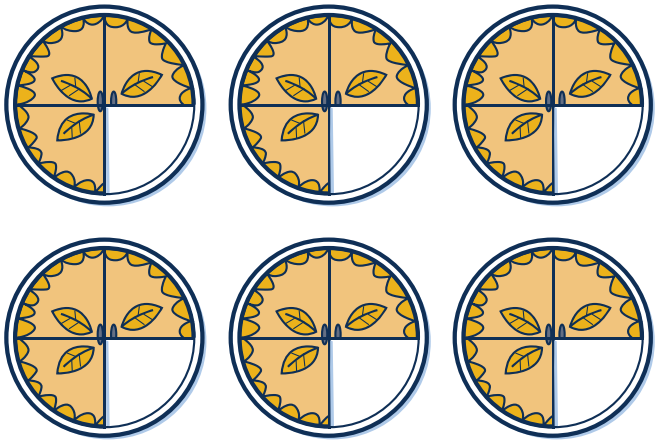
$\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$

You can find out more about mixed numbers and improper fractions in the 'Fractions in School booklet'.

Multiplying fractions by whole numbers

Later in primary school, children are shown how to multiply fractions by a whole number:

Dan knows that each of the 6 people in his family will eat $\frac{3}{4}$ of a pie at tea time. To work out how much pie he needs altogether, he must calculate:



6 lots of three quarters or $\mathbf{6 \times \frac{3}{4}}$

We can see there are **18** quarters, or $\frac{18}{4}$, of pie altogether.

To calculate this without a picture we can say:

6 × 3 (*the numerator*) = **18**

So we have $\frac{18}{4}$.

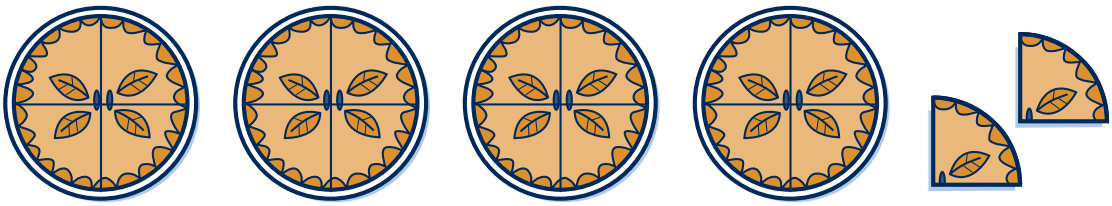
But $\frac{18}{4}$ is an ***improper fraction***, so we then need to turn this answer into a ***mixed fraction***:

How many groups of 4 quarters in 18 quarters?

or

18 ÷ 4 =

4 remainder **2**



So, he needs $4\frac{2}{4}$ pies altogether.

Sometimes we will also need to ***simplify*** the fraction (see page 3)

$$\frac{2}{4} \overset{\div 2}{=} \frac{1}{2}$$

So, he needs $4\frac{1}{2}$ pies altogether.

So to multiply a fraction by a whole number:

Multiply the numerator by the whole number.
Turn the answer into a mixed number if needed.
Simplify the mixed number if needed.

Or, in short:

Multiply numerator by whole number.
Make a mixed number.
Simplify.

You can:

- *Print off multiple copies of the pizza fractions on page 21. Can your child multiply a fraction of pizza by a whole number (e.g. $3 \times \frac{4}{5}$ of pizza), either by writing out a calculation on paper, or in their head? Can they check and show their answer with the pizza fractions?*

Multiplying mixed numbers by whole numbers

Children will also learn how to multiply a mixed number by a whole number, e.g.

$$1\frac{3}{4} \times 5$$

First turn the mixed number into an improper fraction.

$$1\frac{3}{4} = \frac{7}{4}$$

Then, multiply the numerator by the whole number: **7 × 5 = 35**.

So we have $\frac{35}{4}$.

Turn the answer into a mixed number if needed. How many **4**s in **35**? **8**. How many left over? **3**.

So we have $8\frac{3}{4}$ (no need to simplify).

$$1\frac{3}{4} \times 5 = 8\frac{3}{4}$$

Multiplying fractions by fractions

Children also learn how to multiply fractions by fractions.

But what does this actually mean? For example, if we're asked to calculate $\frac{1}{2} \times \frac{3}{4}$, what are we actually looking for?

We're looking for: $\frac{1}{2}$ **of** $\frac{3}{4}$

Multiplying anything by 1 leaves it exactly the same. So, multiplying anything by a proper fraction (less than 1) makes it *smaller.* Really, when we multiply something by a fraction we're finding a **part of it.** Children can find this concept difficult to grasp; practical examples can help.

So, if a recipe asks for $\frac{3}{4}$ of a cup of flour and we want to halve the ingredients, we'll need to find $\frac{1}{2}$ of $\frac{3}{4}$ of a cup, *or:*

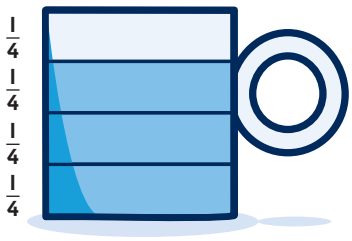
$$\frac{1}{2} \times \frac{3}{4}$$

You can:

- *Check that your child has an understanding of what it is they are really looking for. Can they find another word for the × sign? If not, you can explain that it means* 'of'.

So we want to find $\frac{1}{2}$ of $\frac{3}{4}$ of a cup of flour, or:

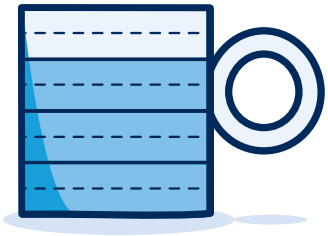
$$\frac{1}{2} \times \frac{3}{4}$$



Finding $\frac{1}{2}$ of $\frac{3}{4}$ of a cup is pretty tricky, because there are 3 parts and therefore it's not easy to split into 2.

So we split all 4 of the quarters in the cup into 2: we multiply 2 × 4 to get a total of 8 parts:

$$\frac{1}{2} \times \frac{3}{4} = 8$$



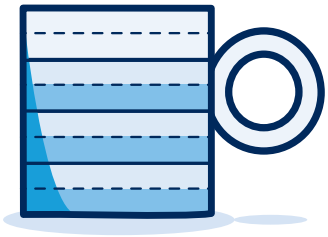
Now each of the quarters is split into 2 equal pieces.

We can take 1 out of 2 ($\frac{1}{2}$) from each of the 3 quarters with flour in:

We're taking 1 part 3 times over

or 1 × 3

$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$



In total we have 3 out of a possible 8 parts in the cup, or $\frac{3}{8}$ of a cup.

So:

$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

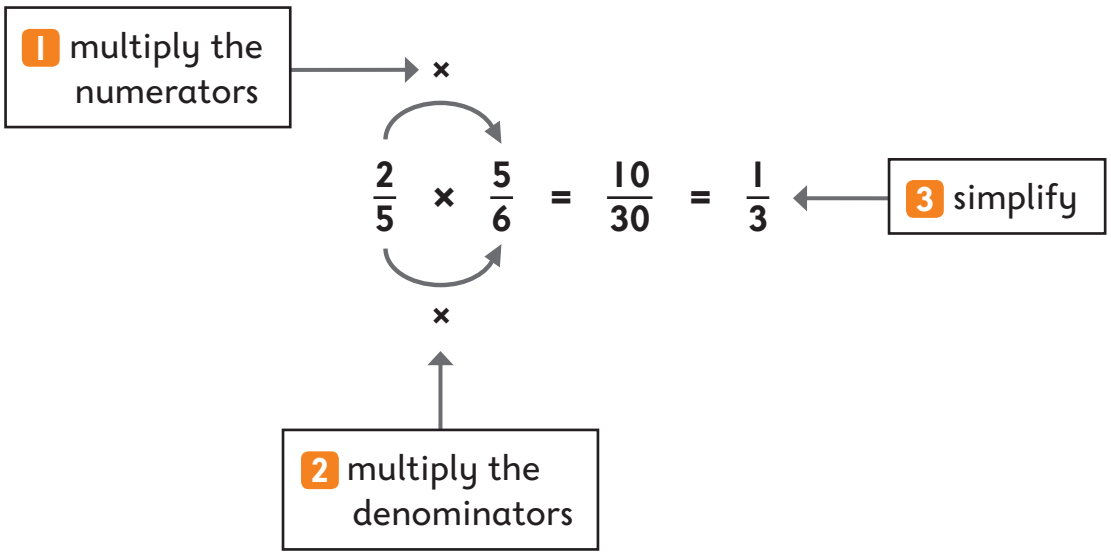
(and $\frac{3}{8}$ can't be simplified)

So, to multiply a fraction by a fraction:

Multiply the numerators.
Multiply the denominators.
(Simplify if possible.)

Here's a quicker example:

$$\frac{2}{5} \times \frac{5}{6}$$



You can:

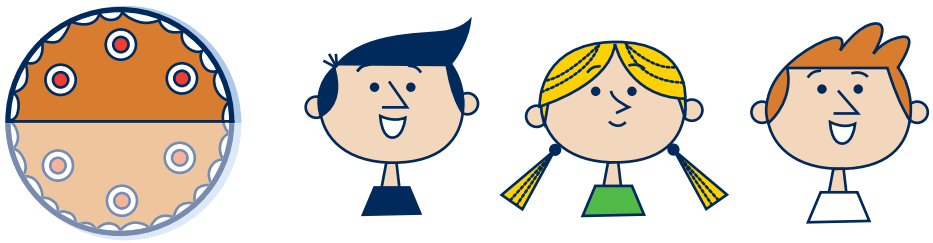
- *Play the Multiplying fractions game on page 20 with your child to help them practise multiplying fractions by fractions.*

Dividing fractions by whole numbers

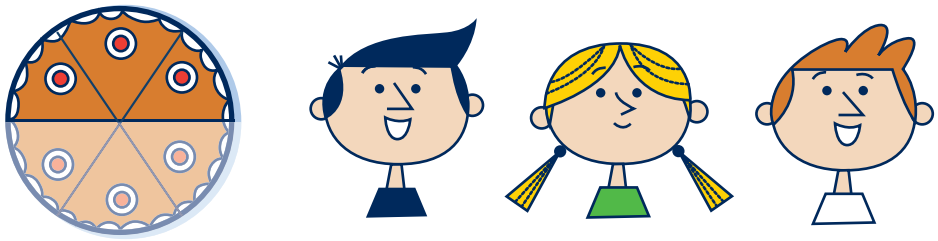
Children also learn how to divide fractions by whole numbers.

Here's a whole cake. **3** children have been told they can share $\frac{1}{2}$ of the cake between them. They want to work out what fraction of the cake they will each have. So they need to calculate:

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



The children split their half of the cake into 3 equal pieces. They also split the other half into 3 pieces of the same size, to see what fraction of the ***whole*** cake they'll be getting.

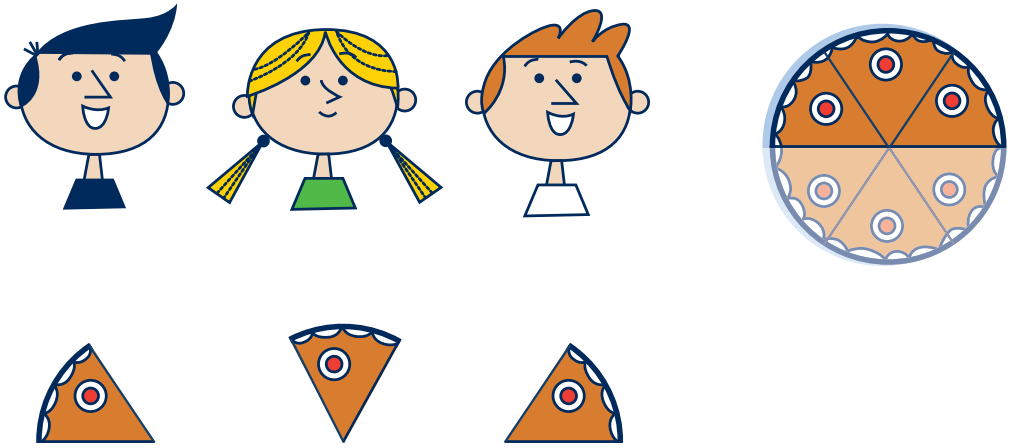


The children have split each of the **2** pieces into **3**, so they now have **2 × 3** pieces of cake = **6** pieces of cake

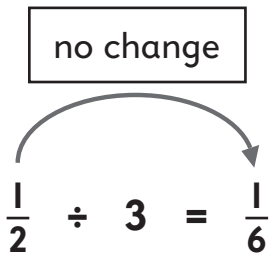
$$\frac{1}{2} \div 3 = \frac{1}{6}$$

×

Each child can have 1 of these pieces: 1 out of 6, or $\frac{1}{6}$:



So:



$$\frac{1}{2} \div 3 = \frac{1}{6}$$

(and it's not possible to simplify $\frac{1}{6}$)

So, to divide a fraction by a whole number:

Multiply the denominator by the whole number.
Simplify if needed.

You can:

- *Cut out the pizzas on page 21. Can your child choose a fraction of a pizza and divide it by a whole number? Can they name the fraction in the answer? Can they show a written method, as above, as well as cutting or drawing on the pizza fractions?*

Decimals and fractions

Our children learn that fractions can be expressed in other ways, such as decimals numbers.

24 · 13

is a decimal number

It contains a decimal point. Any digits before the decimal point (purple) are whole numbers that represent whole things. Any digits after the decimal point (blue) represent parts, or fractions, of whole things. Look at the same number on this place value chart:

Hundreds 100	Tens 10	Units 1	•	Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$
	2	4	•	1	3

We can see that the digit straight after the decimal point (the 1) is worth tenths of a whole thing, in this case $\frac{1}{10}$.

Digits two places after the decimal point (the 3) are worth hundredths of a whole thing, in this case $\frac{3}{100}$.

Digits in the next column are worth thousandths ($\frac{1}{1000}$s). In the next column they're worth ten thousandths ($\frac{1}{10000}$s) and so on.

Turning decimals into fractions

To turn a decimal into a fraction we simply write it over 10 if there is one digit after the decimal, over 100 if there are two digits, over 1000 if there are three digits and so on. Then, if it's possible, we simplify the fraction.

Here are some examples:

$$0{\cdot}1 = \frac{1}{10}$$

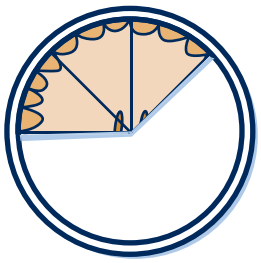
$$0{\cdot}25 = \frac{25}{100} = \frac{1}{4}$$

$$1{\cdot}457 = 1\,\frac{457}{1000}$$

Turning fractions into decimals

Children will also learn how to turn fractions into decimals.
Take a look at this fraction:

$\frac{3}{8}$



We've seen that the line in a fraction can be said as ***'out of'***, e.g. 'We have 3 ***out of*** 8 slices of pie left.'

The line can also be said as ***'divided by'***: 3 ***divided by*** 8. If we had 3 whole pies and divided them into 8 equal pieces we'd have exactly this amount of pie in each piece!

And if we actually do the calculation, if we divide **3** by **8**, we turn the fraction into a decimal that also describes exactly how much of one whole pie we have left (children can use a calculator if they need to):

3 ÷ 8 = 0·375, So $\frac{3}{8}$ **= 0·375,** and we have **0·375** of a pie!

In school, children are helped to remember some common decimal and fraction pairs, without always having to work them out mathematically.

For example:

$$\frac{1}{4} = 0 \cdot 25$$

$$\frac{1}{2} = 0 \cdot 5$$

$$\frac{3}{4} = 0 \cdot 75$$

$$\frac{1}{10} = 0 \cdot 1$$

Percentages and fractions

In their later years at primary school, children learn about percentages:

19%

Percentages have the same value as fractions with a denominator of 100. So:

$$19\% = \frac{19}{100}$$

or

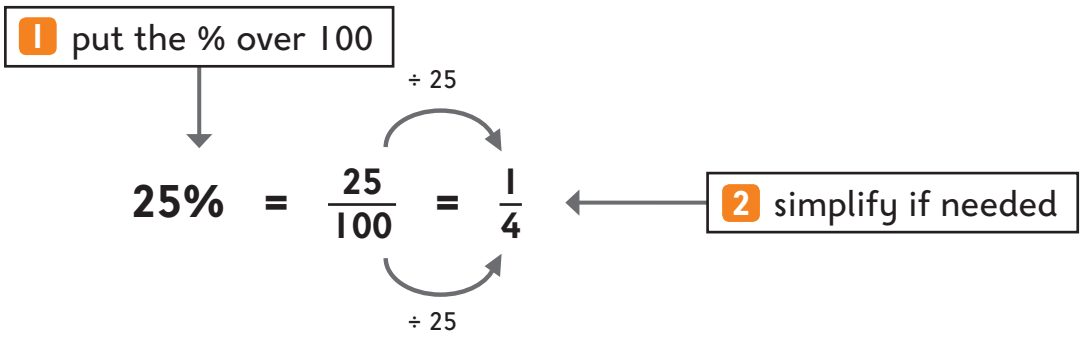
19 out of 100

So, to turn a percentage into a fraction we:

Put the percentage over 100.

Simplify if needed.

Here's another example:



Children are helped to remember some common percentage and fraction pairs, so that they don't always have to work them out mathematically.

You can:

- *Help your child to practise matching fractions, decimals and percentages by playing the Fractions, Decimals and Percentages Treasure Hunt game in the Fun Activities section of the Oxford Owl website.*

The more our children identify, discuss, use and play with fractions in their everyday lives, when eating or playing or when out and about, the easier they will find using them in all aspects of their lives.

Multiplying fraction madness game

Cut out the fraction cards. Place them all upside down on a table.

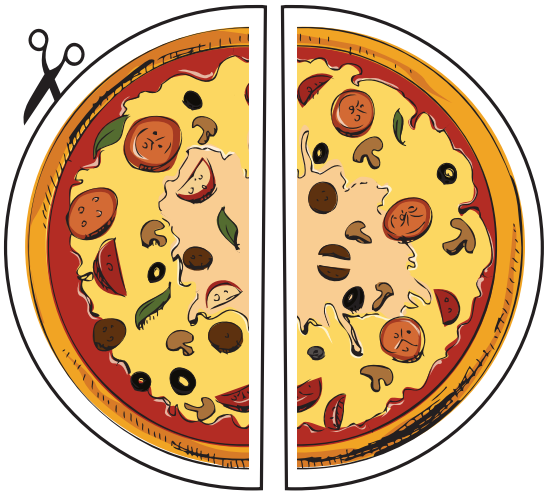
One player: Set a time limit for the game. Pick two cards. Multiply the two fractions, using paper as needed. See how many calculations you can complete in the given time.

Two players: Each player picks two cards. Who can multiply their fractions first?

(Use the method in the Multiplying fractions by fractions section on page 12 to help you check your answers)

$\frac{1}{2}$	$\frac{3}{5}$	$\frac{1}{3}$	$\frac{4}{5}$
$\frac{1}{4}$	$\frac{5}{6}$	$\frac{1}{5}$	$\frac{2}{7}$
$\frac{1}{6}$	$\frac{3}{7}$	$\frac{1}{7}$	$\frac{4}{7}$
$\frac{1}{8}$	$\frac{5}{7}$	$\frac{2}{3}$	$\frac{6}{7}$
$\frac{3}{4}$	$\frac{3}{8}$	$\frac{2}{5}$	$\frac{5}{8}$

Pizza fractions



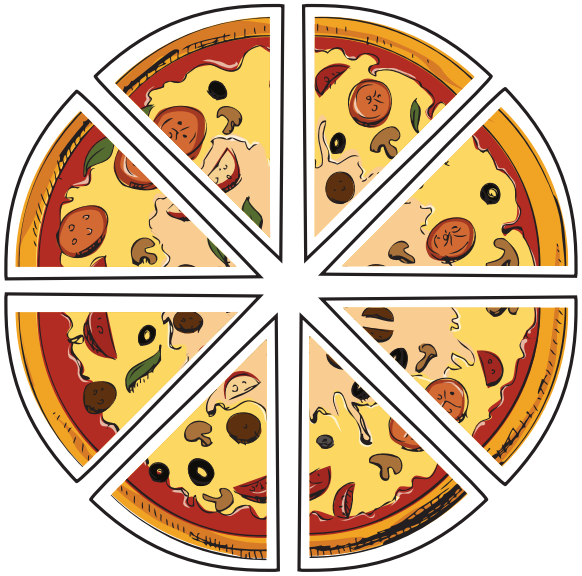
halves

thirds

quarters

fifths

sixths



eighths