

**Long multiplication**

As you did when adding and subtracting, keep your place value columns lined up neatly. You need to be aware of the place value of the number you are multiplying by.

Calculate  $1429 \times 32$

$$\begin{array}{r} 1429 \times \\ \underline{32} \\ 2848 \end{array}$$

Line up matching place values  
Multiply the 1429 by 2  
Carry over any 'tens' values after multiplying

$$\begin{array}{r} 1429 \times \\ \underline{32} \\ 2858 \\ 32670 \end{array}$$

For  $1429 \times 3$  tens, put a 0 in the ones column and multiply by 3  
Carry over any 'tens' values after multiplying

$$\begin{array}{r} 1429 \times \\ \underline{32} \\ 2858 + \\ 42870 \\ \hline 45728 \end{array}$$

Add the two new numbers together

$\therefore 1429 \times 32 = 45728$

Here is another example. Be careful to line up the columns correctly.

Calculate  $423 \times 506$

$$\begin{array}{r} 423 \times \\ \underline{506} \\ 2428 \end{array}$$

Line up matching place values  
Multiply the 423 by 6  
Carry over any 'tens' values after multiplying

$$\begin{array}{r} 423 \times \\ \underline{506} \\ 2538 \\ 0000 \end{array}$$

For  $423 \times 0$  tens, put a 0 in the ones column first and multiply by 0

$$\begin{array}{r} 423 \times \\ \underline{506} \\ 2538 \\ 0000 \\ 200500 \end{array}$$

For  $423 \times 5$  hundreds, put a 0 in the ones **and** tens columns and multiply by 5  
Carry over the 'tens' value after multiplying

$$\begin{array}{r} 423 \times \\ \underline{506} \\ 2538 + \\ 0000 \\ 211500 \\ \hline 214038 \end{array}$$

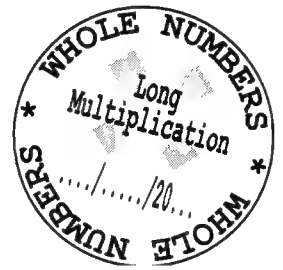
Add the two new numbers together

$\therefore 423 \times 506 = 214038$





## Long multiplication



- 1 Calculate each of these multiplication questions showing all working.  
Check your answers on the calculator.

a  $3016 \times 21$

$$\begin{array}{r} 3016 \\ \times 21 \\ \hline 6032 \\ 60320 \\ \hline 63336 \end{array}$$

b  $2581 \times 19$

$$\begin{array}{r} 2581 \\ \times 19 \\ \hline 23229 \\ 25810 \\ \hline 49039 \end{array}$$

c  $9570 \times 63$

$$\begin{array}{r} 9570 \\ \times 63 \\ \hline 28710 \\ 574200 \\ \hline 602910 \end{array}$$

d  $3876 \times 45$

$$\begin{array}{r} 3876 \\ \times 45 \\ \hline 19380 \\ 155040 \\ \hline 174420 \end{array}$$

e  $1012 \times 37$

$$\begin{array}{r} 1012 \\ \times 37 \\ \hline 7084 \\ 30360 \\ \hline 37444 \end{array}$$

f  $20202 \times 15$

$$\begin{array}{r} 20202 \\ \times 15 \\ \hline 101010 \\ 202020 \\ \hline 303030 \end{array}$$



## Long multiplication

- 2 Calculate each of these multiplication questions showing all working. Check your answers on the calculator.

a

$$\begin{array}{r}
 212 \times \\
 121 \\
 \hline
 212 \\
 4240 \\
 21200 \\
 \hline
 25652
 \end{array}$$

b

$$\begin{array}{r}
 258 \times \\
 405 \\
 \hline
 1290 \\
 10320 \\
 104400 \\
 \hline
 104490
 \end{array}$$

c

$$\begin{array}{r}
 908 \times \\
 209 \\
 \hline
 8172 \\
 00000 \\
 181600 \\
 \hline
 189772
 \end{array}$$

d

$$\begin{array}{r}
 864 \times \\
 345 \\
 \hline
 4320 \\
 34560 \\
 259200 \\
 \hline
 298080
 \end{array}$$

e

$$\begin{array}{r}
 1325 \times \\
 437 \\
 \hline
 9275 \\
 39750 \\
 530000 \\
 \hline
 579025
 \end{array}$$

f

$$\begin{array}{r}
 6485 \times \\
 123 \\
 \hline
 19455 \\
 129700 \\
 648500 \\
 \hline
 797655
 \end{array}$$

## Short and long division

Short and long division are only different due to the size of the number you are dividing by. Here is a short division question.

Calculate  $75\,408 \div 6$

Step 1:	$\begin{array}{r} 1 \\ 6 \overline{)7\,15\,4\,0\,8} \end{array}$	Divide 7 by 6 Put the whole number answer (1) above the 7 Make the remainder (1) the 'tens' digit for the next number
Step 2:	$\begin{array}{r} 1\,2 \\ 6 \overline{)7\,15\,34\,0\,8} \end{array}$	Divide 15 by 6 Put the whole number answer (2) above the 5 Make the remainder (3) the 'tens' digit for the next number
Step 3:	$\begin{array}{r} 1\,2\,5 \\ 6 \overline{)7\,15\,34\,40\,8} \end{array}$	Divide 34 by 6 Put the whole number answer (5) above the 4 Make the remainder (4) the 'tens' digit for the next number
Step 4:	$\begin{array}{r} 1\,2\,5\,6 \\ 6 \overline{)7\,15\,34\,40\,48} \end{array}$	Divide 40 by 6 Put the whole number answer (6) above the 0 Make the remainder (4) the 'tens' digit for the next number
Step 5:	$\begin{array}{r} 1\,2\,5\,6\,8 \\ 6 \overline{)7\,15\,34\,40\,48} \end{array}$	Divide 48 by 6 Put the answer (8) above the 8

$$\therefore 75\,408 \div 6 = 12\,568$$

If there is a remainder at the end, always write it as a fraction.



$$\text{remainder fraction} = \frac{\text{the amount left over}}{\text{the divisor}}$$

Calculate  $518 \div 3$

Step 1:	$\begin{array}{r} 1 \\ 3 \overline{)5\,21\,8} \end{array}$	Divide 5 by 3 Put the whole number answer (1) above the 5 Make the remainder (2) the 'tens' digit for the next number
Step 2:	$\begin{array}{r} 1\,7 \\ 3 \overline{)5\,21\,8} \end{array}$	Divide 21 by 3 Put the whole number answer (7) above the 1 There is no remainder this time
Step 3:	$\begin{array}{r} 1\,7\,2\,\frac{2}{3} \\ \text{divisor} \rightarrow 3 \overline{)5\,21\,8} \end{array}$	Divide 8 by 3 Put the whole number answer (2) above the 8 Write the remainder as a fraction ( $\frac{2}{3}$ ) to the right

$$\therefore 518 \div 3 = 172\frac{2}{3}$$



## Short and long division



- 1 Calculate each of these short division questions showing all working.  
Check your answers on the calculator.

a  $4767 \div 3$

$$\begin{array}{r} 1589 \\ 3 \overline{) 4767} \\ \underline{3} \phantom{00} \\ 17 \phantom{00} \\ \underline{15} \phantom{00} \\ 26 \phantom{00} \\ \underline{24} \phantom{00} \\ 27 \\ \underline{27} \\ 0 \end{array}$$

b  $6180 \div 5$

$$\begin{array}{r} 1236 \\ 5 \overline{) 6180} \\ \underline{5} \phantom{00} \\ 11 \phantom{00} \\ \underline{10} \phantom{00} \\ 18 \phantom{00} \\ \underline{15} \phantom{00} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

c  $6912 \div 4$

$$\begin{array}{r} 1728 \\ 4 \overline{) 6912} \\ \underline{4} \phantom{00} \\ 29 \phantom{00} \\ \underline{28} \phantom{00} \\ 13 \phantom{00} \\ \underline{12} \phantom{00} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

d  $12054 \div 6$

$$\begin{array}{r} 02009 \\ 6 \overline{) 12054} \\ \underline{6} \phantom{000} \\ 6 \phantom{000} \\ \underline{6} \phantom{000} \\ 0 \phantom{000} \\ 54 \\ \underline{54} \\ 0 \end{array}$$

- 2 Calculate each of these short division questions showing all working.  
(psst: remember to write any remainders as a simplified fraction)  
Check your answers on the calculator.

a  $8965 \div 7$

$$\begin{array}{r} 1280\frac{5}{7} \\ 7 \overline{) 8965} \\ \underline{7} \phantom{000} \\ 19 \phantom{00} \\ \underline{14} \phantom{00} \\ 56 \phantom{00} \\ \underline{56} \phantom{00} \\ 5 \\ \underline{5} \\ 0 \end{array}$$

b  $3879 \div 2$

$$\begin{array}{r} 1939\frac{1}{2} \\ 2 \overline{) 3879} \\ \underline{2} \phantom{000} \\ 18 \phantom{00} \\ \underline{16} \phantom{00} \\ 79 \\ \underline{76} \\ 39 \\ \underline{38} \\ 19 \\ \underline{18} \\ 1 \end{array}$$

c  $9263 \div 8$

$$\begin{array}{r} 1157\frac{7}{8} \\ 8 \overline{) 9263} \\ \underline{8} \phantom{000} \\ 12 \phantom{00} \\ \underline{8} \phantom{00} \\ 46 \phantom{00} \\ \underline{40} \phantom{00} \\ 63 \\ \underline{56} \\ 7 \\ \underline{7} \\ 0 \end{array}$$

d  $5801 \div 6$

$$\begin{array}{r} 0966\frac{5}{6} \\ 6 \overline{) 5801} \\ \underline{6} \phantom{000} \\ 58 \phantom{00} \\ \underline{54} \phantom{00} \\ 40 \phantom{00} \\ \underline{36} \phantom{00} \\ 41 \\ \underline{36} \\ 5 \\ \underline{5} \\ 0 \end{array}$$

## Multiplying with decimals

Just write the terms as whole numbers and multiply. Put the decimal point back in when finished.

The number of decimal places in the answer = the number of decimal places in the question!

1 Calculate  $4 \times 1.2$

$$4 \times 12 = 48$$

Multiply both terms as whole numbers

$$\begin{array}{r} 1 \\ \times \\ 48 \\ \hline \end{array}$$

1 decimal place in question = 1 decimal place in answer

$$\therefore 4 \times 1.2 = 4.8$$

2 Calculate  $0.02 \times 1.45$

$$2 \times 145 = 290$$

Multiply both terms as whole numbers

$$\begin{array}{r} 4321 \\ \times \\ 290 \\ \hline \end{array}$$

$$\therefore 0.02 \times 1.45 = 0.0290$$

4 decimal places in question = 4 decimal places in answer

How does this work when multiplying with decimals? Excellent question! Very glad you asked!

Let's do the second one again but this time change the decimals to equivalent fractions first

$$0.02 \times 1.45 = \frac{2}{100} \times \frac{145}{100}$$

Changing the decimals to fractions

$$= \frac{2 \times 145}{100 \times 100}$$

Multiply numerators and denominators together

$$= \frac{290}{10\,000}$$

Number of zeros in denominator = total of decimal places in question

$$= 290 \div 10\,000$$

$$= \begin{array}{r} 4321 \\ \times \\ 290 \\ \hline \end{array} = 0.290$$

Dividing by 10 000 moves decimal point four places to the left

$$= 0.0290$$

$\therefore$  4 decimal places in question = 4 decimal places in answer

Try this method for yourself on the first example above, remembering that  $4 = \frac{4}{1}$  as a fraction.



## Multiplying with decimals

1 Calculate these whole number and decimal multiplications, showing all you working:

a  $0.8 \times 2$

$$8 \times 2 = 16$$

$$0.8 \times 2 = 1.6$$

b  $5 \times 1.5$

$$5 \times 15 = 75$$

$$5 \times 1.5 = 7.5$$

c  $0.14 \times 6$

$$14 \times 6 = 84$$

$$0.14 \times 6 = 0.84$$

d  $0.62 \times 4$

$$62 \times 4 = 248$$

$$0.62 \times 4 = 2.48$$

e  $3 \times 0.032$

$$3 \times 32 = 96$$

$$3 \times 0.032 = 0.096$$

f  $1.134 \times 2$

$$1134 \times 2 = 2268$$

$$1.134 \times 2 = 2.268$$

2 Calculate these decimal multiplications, showing all your working:

a  $3.8 \times 0.2$

$$38 \times 2 = 76$$

$$3.8 \times 0.2 = 0.76$$

b  $1.09 \times 0.08$

$$109 \times 8 = 872$$

$$1.09 \times 0.08 = 0.0872$$

c  $2.7 \times 2.5$

$$27 \times 25 = 675$$

$$2.7 \times 2.5 = 6.75$$

d  $7.1 \times 1.4$

$$71 \times 14 = 994$$

$$7.1 \times 1.4 = 9.94$$

e  $3.21 \times 2.1$

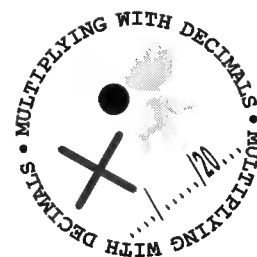
$$321 \times 21 = 6741$$

$$3.21 \times 2.1 = 6.741$$

f  $17.2 \times 9.3$

$$172 \times 93 = 15996$$

$$17.2 \times 9.3 = 159.96$$



## Dividing with decimals

Opposite to multiplying, we move the decimal point before dividing if needed.

To find the quotient involving decimals, the question must be changed so the divisor is a whole number.

$$\text{dividend} \div \text{divisor} = \text{quotient}$$

- Calculate  $4.28 \div 4$

$$\begin{array}{r} 1.07 \\ 4 \overline{)4.28} \end{array}$$

Divisor already a whole number so no change needed

$$\therefore 4.28 \div 4 = 1.07$$

- Calculate  $0.0456 \div 0.006$

$$0.0456 \div 0.006 = 0.0456 \div 0.006 \quad \text{Move both decimal points right until divisor is a whole number}$$

$$= 45.6 \div 6$$

$$\begin{array}{r} 07.6 \\ 6 \overline{)45.6} \end{array}$$

Quotient > Dividend  
if divisor < 1

$$\therefore 0.0456 \div 0.006 = 7.6$$

Drop off any 0s at the front of the answer

Here's another example showing how to treat remainders

Calculate  $1.26 \div 0.8$

$$1.26 \div 0.8 = 1.26 \div 0.8 \quad \text{Move both decimal points right until divisor is a whole number}$$

Move both decimal points right until divisor is a whole number

$$= 12.6 \div 8$$

$$\begin{array}{r} 01.575 \\ 8 \overline{)12.600} \end{array}$$

Add 0s on the end of the dividend for each new remainder

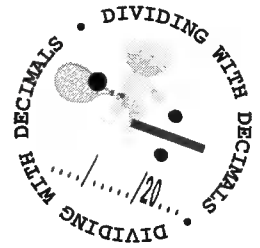
$$\therefore 1.26 \div 0.8 = 1.575$$

Drop off any 0s at the front





## Dividing with decimals



1 Calculate these decimal and whole number divisions:

a  $3.6 \div 4$

$$\begin{array}{r} 0.9 \\ 4 \overline{) 3.6} \end{array}$$

$$\therefore 3.6 \div 4 = 0.9$$

b  $17.5 \div 5$

$$\begin{array}{r} 3.5 \\ 5 \overline{) 17.5} \end{array}$$

$$\therefore 17.5 \div 5 = 3.5$$

c  $16.2 \div 9$

$$\begin{array}{r} 1.8 \\ 9 \overline{) 16.2} \end{array}$$

$$\therefore 16.2 \div 9 = 1.8$$

d  $0.63 \div 3$

$$\begin{array}{r} 0.21 \\ 3 \overline{) 0.63} \end{array}$$

$$\therefore 0.63 \div 3 = 0.21$$

e  $0.489 \div 5$

$$\begin{array}{r} 0.0978 \\ 5 \overline{) 0.4890} \end{array}$$

$$\therefore 0.489 \div 5 = 0.0978$$

f  $10.976 \div 7$

$$\begin{array}{r} 1.568 \\ 7 \overline{) 10.976} \end{array}$$

$$\therefore 10.976 \div 7 = 1.568$$

2 Calculate these decimal divisions, showing all your working:

a  $5.2 \div 0.4$

$$\begin{array}{r} 13 \\ 4 \overline{) 5.2} \end{array}$$

$$\therefore 5.2 \div 0.4 = 13$$

b  $9.6 \div 0.6$

$$\begin{array}{r} 16 \\ 6 \overline{) 9.6} \end{array}$$

$$\therefore 9.6 \div 0.6 = 16$$

c  $0.56 \div 0.8$

$$\begin{array}{r} 0.7 \\ 8 \overline{) 0.56} \end{array}$$

$$\therefore 0.56 \div 0.8 = 0.7$$

d  $1.58 \div 0.4$

$$\begin{array}{r} 3.95 \\ 4 \overline{) 1.580} \end{array}$$

$$\begin{aligned} \therefore 1.58 \div 0.4 \\ = 3.95 \end{aligned}$$

e  $0.8125 \div 0.05$

$$\begin{array}{r} 16.25 \\ 5 \overline{) 0.8125} \end{array}$$

$$\begin{aligned} \therefore 0.8125 \div 0.05 \\ = 16.25 \end{aligned}$$

f  $5.3682 \div 0.006$

$$\begin{array}{r} 894.7 \\ 6 \overline{) 5.3682} \end{array}$$

$$\begin{aligned} \therefore 5.3682 \div 0.006 \\ = 894.7 \end{aligned}$$

### Improper fractions and mixed numerals

An improper fraction has a bigger numerator (top) than denominator (bottom)

$$\frac{3}{2} \longleftarrow \text{Improper fractions} \longrightarrow \frac{5}{4}$$

numerator > denominator

> means 'bigger than'



Mixed numerals have a whole number and a proper fraction.

$$1\frac{1}{2} \longleftarrow \text{Mixed numerals} \longrightarrow 1\frac{1}{4}$$

A 'mix' of whole numbers and proper fractions.

Mixed numerals are simplified improper fractions.

#### Simplify these

Improper fractions to mixed numerals

(i)  $\frac{5}{3}$

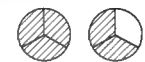
$$\frac{5}{3} = 5 \div 3$$

$$\frac{\text{numerator}}{\text{denominator}} = \text{numerator} \div \text{denominator}$$

$$= 1r2$$

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

Whole number answer  $\rightarrow$  remainder  
same denominator



(ii)  $\frac{14}{4}$

$$\frac{14}{4} = \frac{7}{2} = 7 \div 2 \quad \text{Simplify if possible}$$

$$= 3r1$$

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

Whole number answer  $\rightarrow$  remainder  
same simplified denominator

picture form



Mixed numerals to improper fractions

(i)  $1\frac{2}{3}$

$$1\frac{2}{3} = \frac{3 \times 1 + 2}{3}$$

$$= \frac{5}{3} \quad \text{same denominator}$$

(ii)  $2\frac{1}{5}$

$$2\frac{1}{5} = \frac{5 \times 2 + 1}{5}$$

$$= \frac{11}{5} \quad \text{same denominator}$$



## Improper fractions and mixed numerals

1 Write the mixed numerals represented by these shaded diagrams:

a =  $2 \frac{2}{3}$

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

c =  $3 \frac{2}{5}$

d =  $1 \frac{1}{4}$

Make sure you write the fraction in simplest form where possible.

e =  $2 \frac{1}{2}$

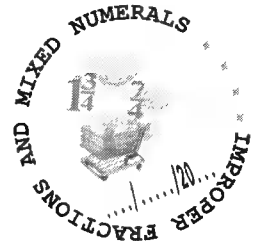
f =  $3 \frac{3}{4}$

2 Simplify these improper fractions by writing them as mixed numerals.

a  $\frac{12}{5} = 2 \frac{2}{5}$

b  $\frac{14}{3} = 4 \frac{2}{3}$

c  $\frac{23}{2} = 11 \frac{1}{2}$



3 Write these fractions in simplest form first, then change to the mixed numerals.

a  $\frac{15}{9} = \frac{5}{3} = 1 \frac{2}{3}$

b  $\frac{21}{14} = \frac{3}{2} = 1 \frac{1}{2}$

c  $\frac{18}{16} = \frac{9}{8} = 1 \frac{1}{8}$

4 Write the equivalent improper fraction for these mixed numerals.

a  $1 \frac{1}{2} = \frac{3}{2}$

b  $2 \frac{3}{4} = \frac{11}{4}$

c  $4 \frac{4}{5} = \frac{24}{5}$

5 Write the equivalent improper fraction for these mixed numerals after first simplifying the fraction parts.

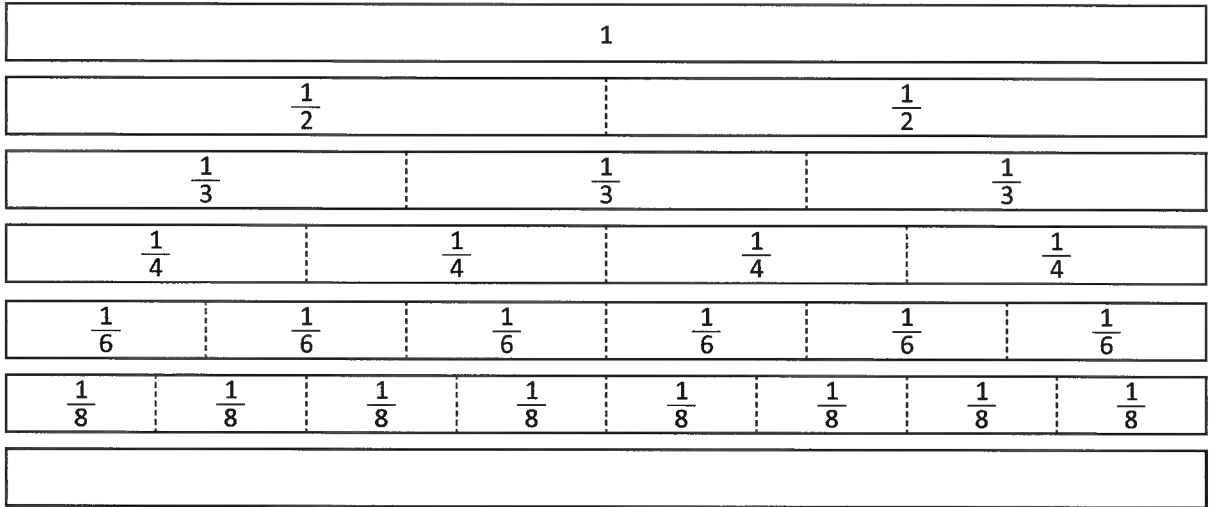
a  $4 \frac{2}{12} = 4 \frac{1}{6} = \frac{25}{6}$

b  $2 \frac{6}{24} = 2 \frac{1}{4} = \frac{9}{4}$

c  $25 \frac{24}{72} = 25 \frac{1}{3} = \frac{76}{3}$

# Fractions – equivalent fractions

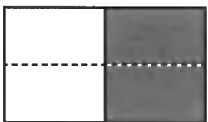
Equivalent fractions have the same value but they have different denominators.  
This means they have been divided into a different number of parts.

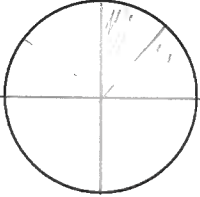


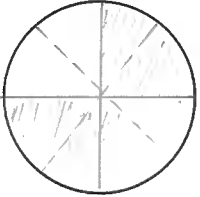
**1** Use the wall to find the equivalent fractions:

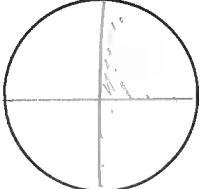
- a What fractions can you find that are equivalent to  $\frac{2}{3}$ ?  $\frac{4}{6}$
- b What fractions can you find that are equivalent to  $\frac{3}{4}$ ?  $\frac{6}{8}$
- c How many eighths are equivalent to  $\frac{1}{2}$ ? 4
- d How many quarters are equivalent to  $\frac{4}{8}$ ? 2
- e Divide the bottom row into twelfths. Find some equivalent fractions for  $\frac{4}{12}$ .  $\frac{1}{3}, \frac{2}{6}$


**2** Divide and shade the shapes to show the following equivalent fractions. The first one has been done for you.

a  $\frac{1}{2} = \frac{2}{4}$  

b  $\frac{1}{4} = \frac{2}{8}$  

c  $\frac{3}{4} = \frac{6}{8}$  

d  $\frac{1}{2} = \frac{2}{4}$  

e  $\frac{1}{4} = \frac{2}{8}$  

# Fractions – equivalent fractions

To find equivalent fractions without drawing diagrams we use the numerators and denominators to guide us.

Imagine your share of a cake is half. It is too big to pick up so you cut your half into halves. You now have 2 quarters of the cake.

You have doubled the number of parts (the denominator) and by doing this you have doubled the number of parts (the numerator).

This method can be used to find all equivalent fractions.

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

$\begin{matrix} \times 2 \\ \curvearrowright \\ \times 2 \end{matrix}$

### 3 Use the clues to help you make the equivalent fractions:

a  $\frac{1}{3} = \frac{4}{12}$

$\begin{matrix} \times 4 \\ \curvearrowright \\ \times 4 \end{matrix}$

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

$\begin{matrix} \times 3 \\ \curvearrowright \\ \times 3 \end{matrix}$

c  $\frac{2}{3} = \frac{6}{9}$

$\begin{matrix} \times 3 \\ \curvearrowright \\ \times 3 \end{matrix}$

d  $\frac{3}{8} = \frac{\square}{40}$

$\begin{matrix} \times 5 \\ \curvearrowright \\ \times 5 \end{matrix}$

e  $\frac{1}{3} = \frac{3}{9}$

$\begin{matrix} \times 3 \\ \curvearrowright \\ \times 3 \end{matrix}$

f  $\frac{1}{4} = \frac{2}{8}$

$\begin{matrix} \times 2 \\ \curvearrowright \\ \times 2 \end{matrix}$

g  $\frac{3}{4} = \frac{15}{20}$

$\begin{matrix} \times 5 \\ \curvearrowright \\ \times 5 \end{matrix}$

h  $\frac{2}{4} = \frac{1}{2}$

$\begin{matrix} \div 2 \\ \curvearrowright \\ \div 2 \end{matrix}$

### 4 We can also reduce the number of parts in a whole. We divide to do this:

a  $\frac{18}{24} = \frac{3}{4}$

$\begin{matrix} \div 6 \\ \curvearrowright \\ \div 6 \end{matrix}$

b  $\frac{9}{21} = \frac{3}{7}$

$\begin{matrix} \div 3 \\ \curvearrowright \\ \div 3 \end{matrix}$

c  $\frac{40}{48} = \frac{5}{6}$

$\begin{matrix} \div 8 \\ \curvearrowright \\ \div 8 \end{matrix}$

d  $\frac{12}{18} = \frac{2}{3}$

$\begin{matrix} \div 6 \\ \curvearrowright \\ \div 6 \end{matrix}$

e  $\frac{12}{21} = \frac{4}{7}$

$\begin{matrix} \div 3 \\ \curvearrowright \\ \div 3 \end{matrix}$

f  $\frac{25}{40} = \frac{5}{8}$

$\begin{matrix} \div 5 \\ \curvearrowright \\ \div 5 \end{matrix}$

Whatever we do to the top, we do to the bottom. Whatever we do to the bottom, we do to the top.



### 5 Answer the following:

a Cassie's table won a pizza for having the most table points at the end of term. There are 6 pupils at the table. What fraction of the pizza will they each receive?  $\frac{1}{6}$

b The pizza has been cut into 12 pieces. How many slices does each pupil get? 2  
 What is this as a fraction?  $\frac{2}{12}$

c Stavros reckons that because they got 2 slices they got more than they would have if the pizza had been cut into 6 pieces. Is he right? Explain your answer with words or diagrams.

No,  $\frac{1}{6} = \frac{2}{12}$

## Fractions – simplifying fractions

These fractions are all equivalent to one half:  $\frac{1}{2}$   $\frac{2}{4}$   $\frac{6}{12}$   $\frac{75}{150}$   $\frac{3455}{6910}$

Which is the simplest?  $\frac{1}{2}$

A fraction is in its simplest form when 1 is the only number that both numbers can be divided by. We simplify fractions to make reading and working with fractions easier.

**1** Circle the simplest fraction in each group:

a  $\frac{1}{2}$   $\frac{2}{4}$   $\frac{50}{100}$

b  $\frac{33}{99}$   $\frac{3}{9}$   $\frac{1}{3}$

c  $\frac{25}{100}$   $\frac{1}{4}$   $\frac{5}{20}$

d  $\frac{2}{3}$   $\frac{6}{9}$   $\frac{16}{24}$

To find the simplest fraction, we divide both the numerator and the denominator by the same number. It makes sense for this to be the biggest number we can find so we don't have to keep dividing. This number is called the **Highest Common Factor (HCF)**.

Look at:

$$\frac{6}{18} = \frac{\boxed{?}}{\boxed{?}}$$

What is the biggest number that goes into both 6 and 18?

6 is the biggest number that goes into 18 and 6.

$$\frac{6 \div 6}{18 \div 6} = \frac{\boxed{1}}{\boxed{3}}$$

**2** Find the highest common factor and then simplify:

a  $\frac{15}{20}$  HCF is  $\boxed{5}$   $\rightarrow \frac{15 \div \boxed{5}}{20 \div \boxed{5}} = \frac{\boxed{3}}{\boxed{4}}$

b  $\frac{9}{30}$  HCF is  $\boxed{3}$   $\rightarrow \frac{9 \div \boxed{3}}{30 \div \boxed{3}} = \frac{\boxed{3}}{\boxed{10}}$

c  $\frac{16}{24}$  HCF is  $\boxed{8}$   $\rightarrow \frac{16 \div \boxed{8}}{24 \div \boxed{8}} = \frac{\boxed{2}}{\boxed{3}}$

d  $\frac{12}{36}$  HCF is  $\boxed{12}$   $\rightarrow \frac{12 \div \boxed{12}}{36 \div \boxed{12}} = \frac{\boxed{1}}{\boxed{3}}$

**3** Wally says he has simplified these fractions as far as he can. Is he right? If not, find the simplest fraction:

a  $\frac{16}{20} \rightarrow \frac{8}{10}$  No,  $\frac{4}{5}$

b  $\frac{50}{100} \rightarrow \frac{25}{50} \rightarrow \frac{5}{10}$  No,  $\frac{1}{2}$

c  $\frac{24}{36} \rightarrow \frac{4}{6}$  No,  $\frac{2}{3}$

d  $\frac{15}{20} \rightarrow \frac{3}{4}$  Yes

# Fractions – simplifying fractions

4 Write the following fractions in their simplest form:

a  $\frac{28}{49} = \frac{4}{7}$

b  $\frac{12}{20} = \frac{3}{5}$

c  $\frac{24}{42} = \frac{4}{7}$

d  $\frac{13}{39} = \frac{1}{3}$

e  $\frac{32}{36} = \frac{8}{9}$

f  $\frac{9}{15} = \frac{3}{5}$

g  $\frac{16}{48} = \frac{1}{3}$

h  $\frac{15}{55} = \frac{3}{11}$

5 Solve the following problems. Write your answers in the simplest form:

a Luke scored  $\frac{16}{20}$  on a test. What fraction was incorrect?  $\frac{4}{20} = \frac{1}{5}$

b Marika scored  $\frac{12}{20}$  on the same test. What fraction did she get right?  $\frac{12}{20} = \frac{3}{5}$

c 25 out of the 75 pupils in Year 6 ride their bikes to school. What fraction does this represent?  $\frac{25}{75} = \frac{1}{3}$

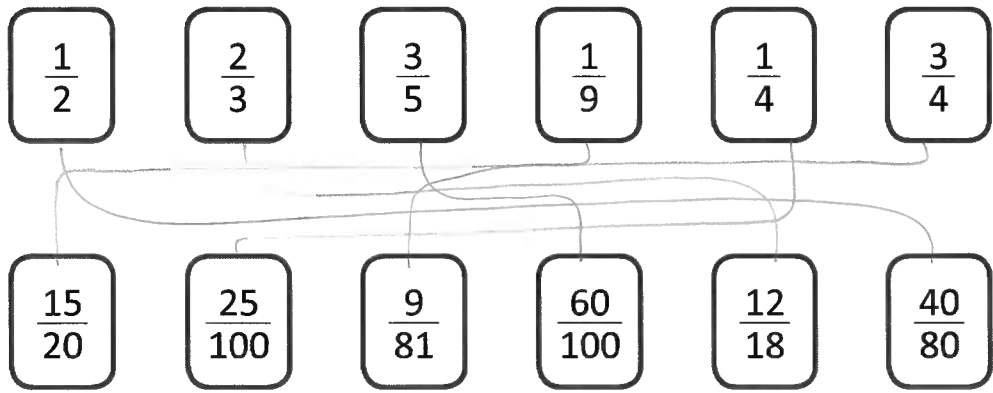
d Out of the 26 pupils in 6F, 14 rate Maths as their favourite subject. What fraction is this?  $\frac{14}{26} = \frac{7}{13}$

e What fraction did not choose Maths as their favourite subject?

If you are not sure what the HCF is, guess, check and improve is a useful strategy. Try your choice out and then look at your new fraction. Could it be any simpler? Is 1 the ONLY number that could go into both the numerator and the denominator?



6 Colour and match the fractions on the bottom row with their simplest form:



# Fractions – comparing and ordering fractions

Comparing and ordering fractions with like denominators is a simple process:

When there are different denominators we need to rename the fractions so they have the same denominators. This lets us compare apples with apples.

Which is larger?  $\frac{3}{4}$  or  $\frac{5}{8}$

We know that  $\frac{3}{4}$  is equivalent to  $\frac{6}{8}$  so  $\frac{3}{4}$  is larger than  $\frac{5}{8}$

1 Order these fractions:

$$1\frac{1}{2}, \frac{5}{4}, \frac{3}{4}, \frac{2}{4}, 1\frac{3}{4}, \frac{1}{4}, \frac{4}{4}$$

$\begin{array}{c} -3 \\ 2 \end{array}$ 
 $\begin{array}{c} 6 \\ 4 \end{array}$ 
 $\begin{array}{c} -7 \\ 4 \end{array}$

$$\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{5}{4}, 1\frac{1}{2}, 1\frac{3}{4}$$



Hmm ... I had better make the mixed numbers into improper fractions as well. That will make them easier to compare.

**THINK**

2 Rename a fraction in each group so that you can compare them more easily. Circle the larger fraction:

a  $\frac{1}{2}$   $\frac{2}{8}$

↓

$\frac{4}{8}$  ,  $\frac{2}{8}$

b  $\frac{4}{8}$   $\frac{3}{4}$

↓

$\frac{4}{8}$   $\frac{6}{8}$

c  $\frac{2}{6}$   $\frac{1}{2}$

↓

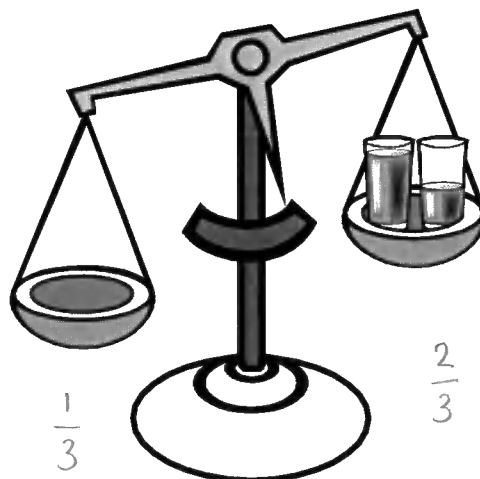
$\frac{2}{6}$   $\frac{3}{6}$

d  $\frac{10}{12}$   $\frac{3}{4}$

↓

$\frac{10}{12}$   $\frac{9}{12}$

3 Write or draw a fraction on the left that would result in the scale looking like this:



Remember with equivalent fractions, we think about what we did to get from one to the other:

$$\frac{2}{3} = \frac{8}{12}$$

$\begin{array}{c} \times 4 \\ \curvearrowright \\ \times 4 \end{array}$



**REMEMBER**



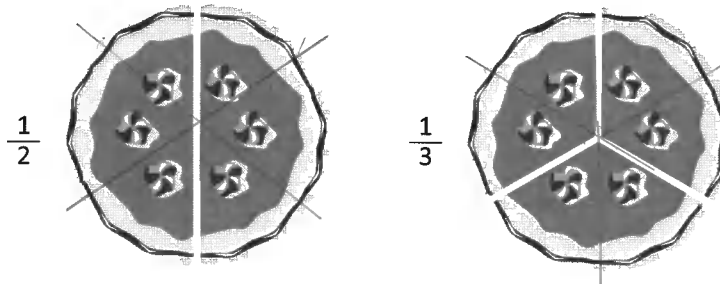
# Fractions – renaming and ordering fractions

Sometimes we have to order and compare fractions with unrelated denominators such as  $\frac{1}{4}$ ,  $\frac{1}{6}$  and  $\frac{1}{5}$ .

To do this, we have to find one common denominator we can convert all the fractions to.

**1** You have 2 cakes for a class party. One has been cut into halves and one into thirds. The problem is that you want each slice to be a fair fraction of the cakes.

a Continue cutting the cakes so that each cake has the same number of fair slices:



b If you had one of these new slices, what fraction of the cake would you receive?

1
6

That is an example of how we rename fractions. We find a way to re-divide the wholes so that they have the **same number of parts**. To do this efficiently we find the smallest shared multiple. This is then called the **Lowest Common Denominator (LCD)**:

$\frac{1}{2}$  The multiples of 2 are 2, 4, 6, 8, ...       $\frac{1}{3}$  The multiples of 3 are 3, 6, 9, 12, 15, ...

6 is the LCD so we convert both fractions to sixths:

$$\frac{1}{2} \begin{array}{l} \times 3 \\ = \\ \times 3 \end{array} \frac{3}{6} \qquad \frac{1}{3} \begin{array}{l} \times 2 \\ = \\ \times 2 \end{array} \frac{2}{6}$$

**2** Rename these fractions by first finding the shared LCD and then converting the fractions. Use the multiplication table on the right to help you find the LCD:

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

6	3	4
12	12	12

b  $\frac{3}{6}$     $\frac{1}{2}$     $\frac{1}{3}$

3	3	2
6	6	6

c  $\frac{1}{3}$     $\frac{1}{4}$     $\frac{1}{6}$

4	3	2
12	12	12

	× 2	× 3	× 4	× 5	× 6
2	3	4	5	6	
4	6	8	10	12	
6	9	12	15	18	
8	12	16	20	24	
10	15	20	25	30	
12	18	24	30	36	
14	21	28	35	42	
16	24	32	40	48	
18	27	36	45	54	

# Fractions – renaming and ordering fractions

**3** Look at each group of fractions. Predict which you think is the largest and circle your prediction. Now, rename the fractions in the work space below so that each fraction in the group has the same denominator. Use a different colour to circle the largest fraction. Are there any surprises?

a  $\frac{1}{2}$   $\frac{2}{3}$   $\frac{3}{9}$       b  $\frac{2}{5}$   $\frac{1}{2}$   $\frac{1}{3}$       c  $\frac{3}{4}$   $\frac{2}{3}$   $\frac{4}{8}$       d  $\frac{3}{4}$   $\frac{3}{6}$   $\frac{3}{8}$

9	12	6
18	18	18

12	15	10
30	30	30

18	16	12
24	24	24

18	12	9
24	24	24

**4** This time, rename the fractions and circle the largest. Underline the smallest.

a  $\frac{3}{8}$   $\frac{2}{4}$   $\frac{5}{6}$       b  $\frac{4}{7}$   $\frac{1}{2}$   $\frac{11}{14}$       c  $\frac{1}{3}$   $\frac{5}{8}$   $\frac{4}{6}$       d  $\frac{3}{4}$   $\frac{2}{3}$   $\frac{1}{2}$

9	12	20
24	24	24

8	7	11
14	14	14

8	15	16
24	24	24

9	8	6
12	12	12

**5** For each fraction write a larger fraction below. The new fraction must have a different denominator. It can have a different numerator.

	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{4}{5}$	$\frac{9}{15}$
	$\frac{15}{30}$	$\frac{10}{30}$	$\frac{20}{30}$	$\frac{24}{30}$	$\frac{18}{30}$
	⇓	⇓	⇓	⇓	⇓
larger fraction	$\frac{16}{30}$	$\frac{11}{30}$	$\frac{21}{30}$	$\frac{25}{30}$	$\frac{19}{30}$

