

REVISE EDEXCEL FUNCTIONAL SKILLS LEVEL 1

Mathematics

REVISION GUIDE

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A small bit of small print

Edexcel publishes Sample Test Materials on its website. This is the official content and this book should be used in conjunction with it. The questions in *Now try this* have been written to help you practise every topic in the book. Remember: the real test questions may not look like this.

Online test preparation

If you are taking the online test, you will need to understand how it works. Before you start, read the instructions about how to use the test and make sure you know what all the icons do.

Useful icons



Time

You can click the Time icon to find out how much time you have left on your test. The time will appear in the bottom right-hand corner.

The timer does not stop when you click on the help button. You will be reminded when you have 15 minutes left, and again when you have 5 minutes left in the test.



Help

You can click this Help icon if you want a demonstration of how the online test buttons work.



Flag

If you are unsure how to answer a question, click the Flag icon and move on to the next question. Come back to the questions you have flagged later.

Before you use the final 5 minutes to check your answers, go back to any questions you have **flagged**.



Review

When you click the Review icon, all your flagged questions will appear. To go back and answer one of the questions you have flagged, click on that line.



Previous



Next

These buttons move you from question to question.



Quit

Be very careful with the Quit button. If you click on it and then click on 'Yes', you will not be able to return to the test even if you haven't finished!

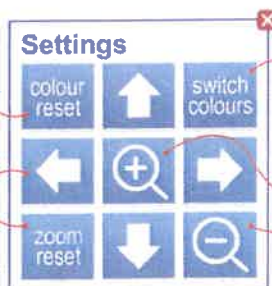
See page 3 for useful tips on how to use the onscreen calculator.

Changing the test settings

Click on the + button in the bottom left-hand corner of the screen to open the settings box.

Use the colour and zoom reset buttons to go back to the original settings.

Click the arrows to move around the page when you are zoomed in.



Click the switch colours icon to change the colour of the test to make it easier to read.

Click the magnifying glass icons to zoom in and out.

Now try this

- 1 How do you find out how much time is left?
- 2 What can you do if you can't read the test clearly?

Online test tools

If you are taking the online test, it is a good idea to prepare by practising using the online tools to answer questions.

1 Show your working

When asked to show your working, write **every step** of your working out in the working out box. Type the numbers and click on the blue buttons to add in symbols.

When you have worked out the answer, you will need to show this by:

- clicking yes or no
- typing your answer in an answer box
- clicking a drop-down list and selecting the right option
- selecting the right answer from a list of options by putting a tick in the box.



You might get marks for working out even if your final answer is wrong.

2 Tables

When you see a table, you could be asked to:

- click a particular row or column
- type information into an empty cell
- drag and drop data into a cell.

To drag and drop:

- 1 Click on the thing you want to move and drag it to where you want it.
- 2 Drop it into the empty space.

Playground

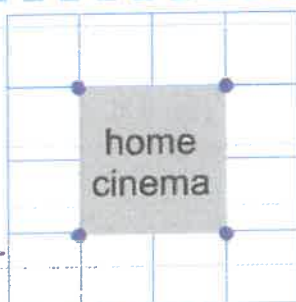
Story time

Drawing

	Session 1	Session 2	Session 3
Group A			
Group B			

3 Shape and space

You could be asked to place an object onto a plan. This object represents a home cinema system.



Click and drag the object to the floor plan. Drag the dots at the corners of the object to resize it.

4 Graphs

You could be asked to display information as a graph. Remember to fill in all the missing information.

- ✓ Type in the graph title.
- ✓ Type in the axis labels and scales. The answer boxes will expand to fit the text you type in them.

- ✓ To plot each point, drag the cross to the graph and drop it in the right position. The red line connecting the points will appear automatically.
- ✓ Check your graph. You can move the points by clicking and dragging them.

Now try this

- 1 Why is it important to show your working out?
- 2 How can you prepare for your online test?

Using the onscreen calculator

You are allowed to use a calculator in your test. Make sure you know how to use one. If you are doing the online test, press the blue button to open the onscreen calculator.

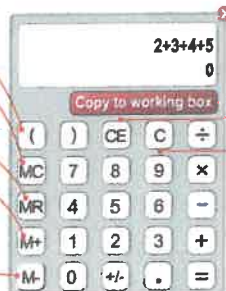
inserts brackets

stores a value in the memory

recalls a value from the memory

adds the number to the memory value

subtracts the number from the memory value



clears the last number entered

clears all calculations

Order of operations

You will sometimes need to do calculations that involve more than one step.

You can enter each step separately or you can type in the whole calculation at once.

If you type in the whole calculation, make sure you use the correct order of operations.

Click 'Copy to working box' to show your working out.

If you are sitting a paper test, you will be allowed to use your own calculator. Make sure you are familiar with how to use it before the test.

Worked example

A nursery teacher buys a toy and a drink for four children. The toy costs 99p and the drink costs 45p. Work out the total amount the teacher spends.

You need to be careful when using your calculator to do all the steps at once. Make sure you put brackets in the right place and always check your answer.

Method 1 – work out each step separately

Cost for a toy and drink for each child:

$$99 + 45 = 144\text{p or } \pounds 1.44$$

Total cost for four children:

$$4 \times \pounds 1.44 = \pounds 5.76$$

Method 2 – use a calculator to do all the steps at once

$$(99 + 45) \times 4 = \pounds 5.76$$

Now try this

For these questions, use your calculator. Write down the buttons you press to do the calculation both in individual steps and all at once.

A carpenter needs to make three tables. The wood for each table costs £26 and the fixings cost £2.

(a) How much will all the tables cost to make?

(b) The carpenter sells each table for £50. How much money does he make?

Number and place value

It is important to know the size of numbers in everyday and work life. A number is made of digits. The more digits a whole number has, the larger the number. The position of the digits is important as it tells you its value and helps you to read the number.

Worked example

- 1 (a) Write the number 8302 in words.

Eight thousand, three hundred and two

- (b) Write the number 121 345 in words.

One hundred and twenty-one thousand, three hundred and forty-five

- (c) Write the number fourteen thousand, three hundred and forty-seven in figures.

14 347

- (d) Write the number two hundred thousand, three hundred and twenty-six in figures.

200 326

- (e) Write the number one million, five hundred thousand and four in figures.

1 500 004

	millions	hundred thousands	ten thousands	thousands	hundreds	tens	units
(a)				8	3	0	2
(b)		1	2	1	3	4	5
(c)			1	4	3	4	7
(d)		2	0	0	3	2	6
(e)	1	5	0	0	0	0	4

The zero means 'no tens'

200 000 or 2 hundred thousands

The zeros fill the empty spaces

Read numbers in groups of three from the right.

1 500 004 reads one million, five hundred thousand and four.

Worked example

- 2 (a) Write down the value of the digit 3 in:

(i) 2356 (ii) 34610 (iii) 230

(iv) 3521467

(i) 300 (ii) 30 000
(iii) 30 (iv) 3 000 000

- (b) Which of these numbers is larger:

(i) 4096 or 4690? (ii) 31 120 or 31 102?

(i) 4690

(ii) 31 120

Compare numbers by looking at the position of the digits. Start from the left side as the value of the digits is larger.

	millions	hundred thousands	ten thousands	thousands	hundreds	tens	units
				4	0	9	6
				4	6	9	0

Start from the largest place value. The digits are the same.

6 hundreds is larger than 0 hundreds. 4690 is larger than 4096.

Now try this

- 1 (a) Write the number 3421 in words.

- (b) Write the number three million, five hundred thousand in figures.

- 2 Write down the value of the 4 in each of these numbers.

(a) 2432 (b) 42321

- 3 The manager of a company needs to order the amount each member of the sales team earned in one month.

Order these amounts from smallest to largest.
£123,506 £38,003 £42,023 £30,803

Negative numbers

Numbers that are greater than zero are called positive numbers. Numbers that are smaller than zero are called negative numbers.

Number lines



A number line can help you put numbers in order of size.

As you go to the **left** the numbers get **smaller**.

As you go to the **right** the numbers get **bigger**.

0 is not positive or negative.

Identifying negative numbers

A **negative number** has a minus (-) sign before it.

-2, -4, -6 are all negative numbers.

A **positive number** sometimes has a plus (+) sign before it. If a number doesn't have a sign before it, you can assume it is **positive**.

+3, 7, 9 are all positive numbers.

Worked example

A company's cash reserve is how much they have in the bank at the end of each month.

When the balance is negative, the company is overdrawn.

1 This table shows the cash reserve a company has at the end of each month for the first six months of the year.

(a) For how many months was the company overdrawn?

four months

January (-£340), April (-£120), May (-£100), June (-£452)

(b) In which month was the company most overdrawn?

June (-£452)

Month	Balance
January	-£340
February	£810
March	£260
April	-£120
May	-£100
June	-£452

Worked example

2 Below is a list of the average February temperatures of six countries.

-1°C, -15°C, -2°C, 2°C, 9°C, -8°C

(a) Order the temperatures from lowest to highest.

-15°C, -8°C, -2°C, -1°C, 2°C, 9°C

(b) How many countries had an average monthly temperature less than -7°C?

Two countries (-15°C and -8°C)

Imagine a number line with all of the values on it. Remember that the further to the left the number is, the lower (colder) it is.

Now try this

1 Write these numbers in order of size. Start with the smallest number.

6, 10, -2, -7, 9, -5

2 In Europe, the temperature of a freezer in a restaurant must be -18°C or less. Which of these temperatures are less than -18°C?

-20°C, -10°C, 19°C, 8°C, -16°C

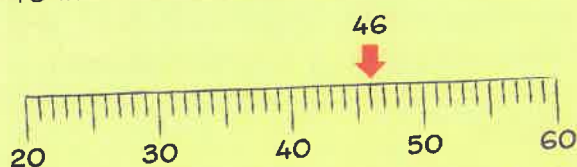
Rounding

It is often easier to use rounded numbers in rough calculations.

Rounding to the nearest 10

Look at the multiples of 10 that the number lies between. Round to the closest multiple. If the number is exactly halfway between the nearest multiples of 10, round up.

46 lies between 40 and 50



46 is closer to 50 so 46 is rounded up to 50

132 lies between 130 and 140



132 is closer to 130 so 132 is rounded down to 130

Worked example

1 (a) A piece of wood measures 46 cm. Round this to the nearest 10 cm.

46 cm rounded to the nearest 10 cm is 50 cm.

(b) A piece of wood measures 132 cm. Round this to the nearest 10 cm.

132 cm rounded to the nearest 10 cm is 130 cm.

Rounding to the nearest 100 or 1000

Rounding to 100 or 1000 works the same as rounding to 10

Look at the nearest multiples of 100 or 1000 and decide which the number is closer to.

Golden rule

	Round up	Round down
Nearest 10	5 or more	less than 5
Nearest 100	50 or more	less than 50
Nearest 1000	500 or more	less than 500

Worked example

2 Last month, 4241 people attended a show at a theatre.

Round this number to the nearest 1000

4241 rounded to the nearest 1000 is 4000

4241 lies between 4000 and 5000
4241 is closer to 4000 so 4241 is rounded down to 4000

Now try this

1 Round these numbers to the nearest 100:

(a) 147 (b) 365 (c) 9123

2 A shop made a profit of £38,827 last year. Round this number to the nearest 1000

Adding and subtracting

For some questions, you need to decide which calculation to do.

Worked example

- 1 A waiter has two customers.

The first customer leaves a tip of £8. The second customer leaves a tip of £15.

- (a) How much does the waiter receive in tips altogether?

$$8 + 15 = £23$$

- (b) The waiter uses his tips to buy a drink which costs £2. How much money does he have left?

$$23 - 2 = £21$$

You need to decide whether to add or subtract.

Use your calculator to work out the answer.

You can check your answer using inverse calculations.

(a) $8 + 15 = 23$ $23 - 8 = 15$ ✓

(b) $23 - 2 = 21$ $21 + 2 = 23$ ✓

Worked example

- 2 Martha is paid £2,000 per month after tax.

Her bills are:

Rent	£720
Electricity and gas	£82
Council tax	£95
Telephone	£32
Water	£28

How much money will she have left when she pays her bills?

$$720 + 82 + 95 + 32 + 28 = 957$$

$$£2,000 - £957 = £1,043$$

Martha will have £1,043 left.

Problem solved!

- ✓ To work out how much Martha spends on bills, you need to **add** all the amounts.
- ✓ To work out how much she has left, you need to **subtract** the bill total from the amount Martha is paid.
- ✓ You should also check your answer by seeing if it is sensible.

Read more about checking your answers on page 12.

Now try this

- 1 Albert sells a motorbike for £2,349 and a helmet for £94. In total, how much money does Albert make?
- 2 In one day, a cafe makes £923. Its outgoings are £437. How much profit does the cafe make that day?

Outgoings are the amount that is spent on goods or staff.

- 3 The table shows the number of clients a plumbing business had each week in February.

Week 1	123
Week 2	75
Week 3	131
Week 4	112

What is the total number of clients the plumbing business had in February?

To find the total add up all the numbers.

Multiplying and dividing by 10, 100 and 1000

You will need to know how to multiply and divide whole numbers by 10, 100 and 1000

Multiplying by 10, 100, 1000

	ten thousands	thousands	hundreds	tens	units
				3	2
$\times 10$			3	2	0
$\times 100$		3	2	0	0
$\times 1000$	3	2	0	0	0

Fill the empty spaces with zeros.

When multiplying by 10, each digit moves one place to the left.

When multiplying by 100, each digit moves two places to the left.

When multiplying by 1000, each digit moves three places to the left.

Worked example

A magnifying glass makes items appear 10 times as big as they really are. An insect is 4 mm long. How long does it look in the magnifying glass?

$$4 \times 10 = 40 \text{ mm}$$

10 times bigger than 4 mm means $10 \times 4 \text{ mm}$

Dividing by 10, 100, 1000

	thousands	hundreds	tens	units	tenths
	2	4	0	0	
$\div 10$		2	4	0	
$\div 100$			2	4	
$\div 1000$				2	4

When dividing by 10, each digit moves one place to the right.

When dividing by 100, each digit moves two places to the right.

When dividing by 1000, each digit moves three places to the right.

Now try this

- Work out: (a) 48×10 (b) 360×1000 (c) $520 \div 100$
- A garage owner needs to order some stock. The table shows the cost of the items she needs. She orders 100 of each item. Calculate the total bill.

Item	Cost
engine oil	£35
car mats	£15
timing chains	£21

Work out the total cost for each item and then add them up.

Multiplication and division

You need to be able to decide whether to multiply or divide to answer a problem.

Worked example

- 1 (a) There are 25 chocolate bars in a box and a shop buys 8 boxes.
How many chocolate bars does the shop buy?

$$25 \times 8 = 200 \text{ chocolate bars}$$

- (b) Sarah makes 30 cakes. She packs them in boxes that hold 6 cakes each. How many boxes does she need?

$$30 \div 6 = 5 \text{ boxes}$$

You can check your answer using the inverse calculation.

$$25 \times 8 = 200 \quad \text{so } 200 \div 8 = 25 \quad \checkmark$$

$$30 \div 6 = 5 \quad \text{so } 5 \times 6 = 30 \quad \checkmark$$

Worked example

- 2 The cost price of a USB stick is £7. A shop buys 36 USB sticks and sells them at £12 each.
Work out how much profit the shop makes.

$$\begin{aligned} \text{Profit for each stick} &= £12 - £7 \\ &= £5 \end{aligned}$$

$$\begin{aligned} \text{Total profit} &= 36 \times £5 \\ &= £180 \end{aligned}$$

Problem solved!

- ✓ Work out the profit made for one stick.
profit = sales price – cost price
- ✓ Multiply the profit for one stick by the number of sticks sold.
- ✓ Don't forget to write your answer in pounds (£).

Worked example

- 3 Freddie works 40 hours per week and gets paid £320.
(a) How much does he get paid per hour?

$$£320 \div 40 = £8$$

- (b) For overtime, Freddie gets paid twice his normal hourly rate. Last month Freddie did 6 hours overtime. What was his overtime pay?

$$£8 \times 2 = £16$$

$$£16 \times 6 = £96$$

Problem solved!

- (a) The question asks about how much he gets paid per hour, so you need to divide.
(b) Double means 'multiply by 2'. Work out his overtime wage and multiply it by the number of overtime hours he does.

Now try this

First work out the profit for one camera.

- 1 252 chairs are to be set up in seven equal rows. How many chairs need to be in each row?
- 2 A coach can seat 52 people. How many people can five coaches seat?
- 3 A shop buys cameras for £18 and sells them for £40. The shop sold six cameras in one day. How much profit did it make that day?

Squares and multiples

You need to be able to recognise and use square numbers and multiples.

Square numbers

When a number is multiplied by itself, the answer is a square number. You can write square numbers using index notation.

Multiplication	Index notation	Square number
2×2	2^2	4
5×5	5^2	25
9×9	9^2	81
13×13	13^2	169

Try multiplying different numbers by themselves. If the answer is less than 40, try a higher number. If the answer is greater than 60, try a lower number.

Worked example

1 Which of these numbers are square numbers?
1, 36, 53, 100, 92

$1 \times 1 = 1$ so 1 is a square number.

$6 \times 6 = 36$ so 36 is a square number.

$10 \times 10 = 100$ so 100 is a square number.

2 Which square number is larger than 40 but smaller than 60?

49 ($7 \times 7 = 49$)

Multiples

The multiples of a number are all of the numbers in its times table.

A common multiple is a number that is a multiple of two or more numbers.

The multiples of 4 are 4, 8, 12, 16, 20, 24...

The multiples of 6 are 6, 12, 18, 24....

12 and 24 are common multiples of 6 and 4 because they are in both lists.

12 is called the lowest common multiple as it is the smallest number in both lists.

Worked example

3 To celebrate its anniversary, a hardware shop gives every sixth customer a free light bulb, and every eighth customer a free pack of batteries.

Which customer will be the first to get both free gifts?

Customers who receive a light bulb

6, 12, 18, 24, 30, 36

Customers who receive a pack of batteries

8, 16, 24, 32

The 24th customer will receive both a light bulb and a pack of batteries.

Problem solved!

Think about how you are going to use multiples to solve this problem.

- ✓ List the multiples of 6
- ✓ List the multiples of 8
- ✓ Identify the first number that is on both lists. This is the lowest common multiple of 6 and 8

Now try this

- Which of these numbers are square numbers? 4, 12, 16, 50, 54
- A house alarm sounds every 5 seconds, and a car alarm sounds every 6 seconds. If they initially sound at the same time, after how many seconds will they next both sound at the same time?

Estimating

Estimating the answer to a calculation is useful when you don't need to know the exact answer. Estimating will give you an answer a little bit more or a little bit less than the exact answer.

Estimation

When you estimate, you need to round the numbers first.

Rounding the numbers makes the calculations easier to do.

Round the numbers to the nearest 10 or 100, and then do the calculation.

Symbol for estimation

The symbol \approx means 'approximately equal to'.

$487 \approx 500$ means 487 is approximately equal to 500

Worked example

1 (a) Work out an estimate for $58 + 31$

Round 58 and 31 to the nearest 10

$$58 \approx 60$$

$$31 \approx 30$$

$$58 + 31 \approx 60 + 30 \\ \approx 90$$

If the number is between 10 and 99, round to the nearest 10

(b) Work out an estimate for $429 - 287$

Round 429 and 287 to the nearest 100

$$429 \approx 400$$

$$287 \approx 300$$

$$429 - 287 \approx 400 - 300 \\ \approx 100$$

If the number is between 100 and 999, round to the nearest 100

Worked example

2 A shop sells T-shirts at £36 each and scarves at £21 each.

John buys 12 T-shirts and 12 scarves.

Estimate how much this will cost.

$$\text{Cost} = 12 \times (36 + 21) \\ \approx 10 \times (40 + 20) \\ \approx 10 \times 60 \\ \approx 600$$

The cost is approximately £600

Problem solved!

Show the examiner that you have rounded each value.

$$12 \approx 10$$

$$36 \approx 40$$

$$21 \approx 20$$

Use these values to find an estimate of the cost.

Now try this

1 Estimate the answer to:

(a) $58 + 71$ (b) $892 - 312$ (c) 48×9

2 Peter sold 89 pairs of scissors for £24 each. They cost him £11. Estimate how much profit he made.

First estimate how much profit he made on selling one pair of scissors.

Checking your answer

It is easy to press the wrong button on your calculator and make a mistake. You should always check your answer is correct.

- ☒ In the test, some questions will have this check symbol next to them. This means that you will be awarded marks for showing how you have checked your answer.

Using estimation

You can use estimation before or after doing a calculation to check if your answer is sensible.

See page 11 for more on estimating answers.

Make sure you show what you have rounded each number to.

Worked example

- 1 Ashia thinks the answer to $599 + 721 - 421$ is 1741

Use estimation to work out if she is correct.

$$599 \approx 600, 721 \approx 700, 421 \approx 400$$

$$600 + 700 - 400 = 900$$

This is a lot lower than 1741 so she has made a mistake in her calculation.

Using inverse operations

You can check if your answer is correct by using inverse operations.

- Adding and subtracting are inverse operations.
- Multiplying and dividing are inverse operations.

Worked example

- 2 Dilek thinks the answer to $400 - 221$ is 179
Is he correct?

$$400 - 221 = 179$$

$$\text{so } 179 + 221 = 400$$

Dilek is correct.

You should always get the number you started with.

Worked example

- 3 Cecily thinks the answer to 43×5 is 228
Is she correct?

If $43 \times 5 = 228$ then $228 \div 5$ must equal 43

$$228 \div 5 = 45.6$$

Cecily is not correct.

You could also check by working out $228 \div 43$

You will have a calculator in the test so you can use it to check your answer.

Now try this

- 1 Dmitri works out $823 + 283 - 789$ and gets the answer 1895
Estimate the answer to the calculation. Is Dmitri correct?
- 2 Use inverse operations to check that these are correct. For any that are incorrect, write down the correct answers.

(a) $423 + 239 = 662$	(b) $39 + 323 = 335$	(c) $53 \times 31 = 1590$	(d) $872 \div 2 = 436$
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Word problems

When you are solving problems, you need to:

- ✓ read the question
- ✓ check your answers
- ✓ decide which calculation you are going to use
- ✓ make sure you have answered the question asked.

Worked example

- 1 The table shows the cost of entrance to a theme park.

adults	£25
children	£12
family (2 adults and 2 children)	£60

Mr and Mrs Svaza want to take their three children to the theme park. Work out the cheapest price they could pay.

$$25 + 25 + 12 + 12 + 12 = £86$$

$$60 + 12 = £72$$

Problem solved!

The question asks for the smallest amount. The total cost of two adult tickets and two child tickets is £86

The total cost of one family ticket and one child ticket is £72, which is lower. £72 is the cheapest price they can pay.

Worked example

- 2 Joseph is looking for a job.
He sees these two adverts online.

Advert A	Advert B
telephone salesperson	telephone salesperson
£280 per week	£8 per hour
40 hours per week	35 hours per week

- (a) Compare the pay for the two adverts.

Advert A

pay per hour: £7

weekly pay: £280

Advert B

pay per hour: £8

weekly pay: £280

- (b) Which job is better paid?

Advert B is better paid because there are fewer working hours but the same weekly pay.

Problem solved!

- (a) Work out the pay per hour. Divide the weekly wage by the number of hours worked.

Work out the pay per week. Multiply the pay per hour by the number of hours worked.

- (b) To decide which job is better paid, you need to look at the pay per week and the pay per hour. As the pay per week is the same, compare the pay per hour.

Now try this

Matthew is planning a trip to the zoo for 5 adults and 10 children. The table shows the entrance costs and travel costs. There is a budget of £400. Is this enough?

Zoo		Train fare	
adult	£18	adult	£16
child	£12	child	£8

Fractions

A fraction is part of a whole. A fraction is made of equal parts.

Here is the flag of Ireland:



1 part is green \longrightarrow 1 \longleftarrow numerator
 out of \longrightarrow 3 \longleftarrow denominator
 3 equal parts \longrightarrow 3 \longleftarrow denominator

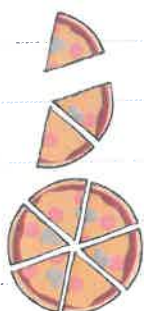
Writing fractions

A pizza is cut into six equal pieces.

One piece of pizza = $\frac{1}{6}$

Two pieces of pizza = $\frac{2}{6}$

The whole pizza = $\frac{6}{6}$ or 1



Recognising fractions in words

You need to be able to recognise fractions written in words.

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

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

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

a tenth = $\frac{1}{10}$

Worked example

(a) What fraction of this shape is shaded?

$\frac{1}{5}$ is shaded

(b) What fraction of the shape is unshaded?

$\frac{4}{5}$ is unshaded



- (a) The diagram is divided into **five** equal parts so the denominator is **5**. **One** part is shaded so the numerator is **1**
 (b) The number of parts that are not shaded is **four**, so the numerator is **4**

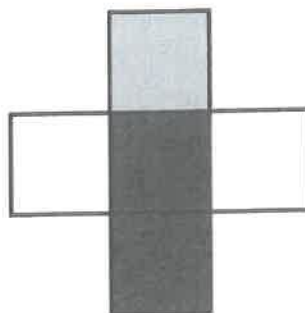
The shaded parts plus the unshaded parts make up the whole: $\frac{1}{5} + \frac{4}{5} = \frac{5}{5}$

Now try this

1 What fraction of this shape is:

- (a) shaded black
 (b) shaded grey
 (c) not shaded?

2 Write $\frac{2}{3}$ in words.



Equivalent fractions

You can compare fractions by using diagrams or equivalent fractions.

Equivalent fractions

Different fractions can describe the same amount. These are called equivalent fractions.



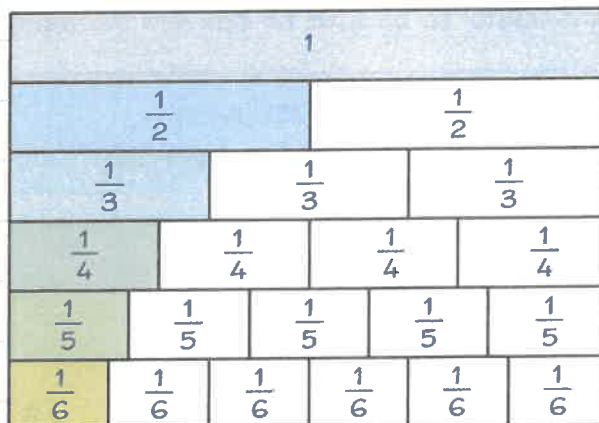
$\frac{1}{2}$ of a pizza is the same amount as $\frac{2}{4}$ of a pizza.

You can find equivalent fractions by multiplying or dividing the numerator and denominator by the same number.

$$\begin{array}{c} \times 2 \div 3 \\ \frac{2}{5} = \frac{4}{10} = \frac{6}{15} \\ \div 2 \times 3 \end{array}$$

Fraction wall

A fraction wall is a good way of seeing equivalent fractions:



Simplifying fractions

If you are asked to **simplify** a fraction, divide the numerator and the denominator by the same amount.

If there isn't a number that divides into both the numerator and the denominator, the fraction is in its **simplest form**.

$$\begin{array}{c} \div 9 \\ \frac{18}{27} = \frac{2}{3} \\ \div 9 \end{array}$$

Comparing fractions

You can compare fractions by writing them as equivalent fractions with the same denominator. Then compare the numerators to decide which is larger.

Worked example

A painter had some paint left in 1 litre tins. The fractions of paint he had left in the tins were: $\frac{1}{3}$, $\frac{2}{9}$, $\frac{5}{9}$. Order the fractions from smallest to largest.

$$\begin{array}{c} \times 3 \\ \frac{1}{3} = \frac{3}{9} \\ \times 3 \end{array}$$

$$\frac{2}{9}, \frac{1}{3}, \frac{5}{9}$$

Change $\frac{1}{3}$ into ninths so you can compare it to the other fractions.

Now try this

1 Copy and complete these equivalent fractions:

(a) $\frac{1}{7} = \frac{\square}{14}$

(b) $\frac{1}{2} = \frac{3}{\square}$

(c) $\frac{3}{8} = \frac{\square}{24}$

2 Using the numbers 1, 4 and 8 what is the smallest fraction you can make?

3 Order these fractions from smallest to largest: $\frac{3}{10}$, $\frac{4}{10}$, $\frac{1}{5}$

Mixed numbers

Mixed numbers have a whole number part and a fraction part.

$3\frac{1}{4}$ is the same as $3 + \frac{1}{4}$

Improper fractions have a numerator larger than their denominator.

$\frac{5}{2}$ and $\frac{21}{5}$ are both improper fractions.

It is useful to be able to convert between mixed numbers and improper fractions.

Converting a mixed number to an improper fraction

To convert a mixed number to an improper fraction...

Multiply the whole number...

...by the denominator... $3\frac{1}{4} = \frac{(3 \times 4) + 1}{4} = \frac{13}{4}$

...and add it to the numerator.

Keep the same denominator.

Worked example

1 Change each mixed number into an improper fraction.

(a) $4\frac{5}{6} \quad \frac{(4 \times 6) + 5}{6} = \frac{29}{6}$

(b) $3\frac{4}{9} \quad \frac{(3 \times 9) + 4}{9} = \frac{31}{9}$

Multiply the whole number by the denominator, add the numerator.

Converting an improper fraction to a mixed number

To convert an improper fraction to a mixed number...

Divide the numerator... $\frac{23}{5} = 23 \div 5 = 4\frac{3}{5}$ Write the remainder as the numerator.

...by the denominator.

Keep the same denominator.

Worked example

2 Change each improper fraction into a mixed number.

(a) $\frac{34}{5} \quad 34 \div 5 = 6 \text{ r } 4 \text{ so } \frac{34}{5} = 6\frac{4}{5}$

(b) $\frac{32}{9} \quad 32 \div 9 = 3 \text{ r } 5 \text{ so } \frac{32}{9} = 3\frac{5}{9}$

Divide the numerator by the denominator.

Now try this

1 Work out $\frac{2}{3} + \frac{2}{3}$. Write your answer as an improper fraction.

2 Write $5\frac{5}{9}$ as an improper fraction.

3 Write $\frac{45}{6}$ as a mixed number.

Fractions of amounts

You need to be able to find fractions of amounts.

Fractions of amounts

If the numerator is 1, divide by the denominator.

$\frac{1}{3}$ of £120

$$£120 \div 3 = £40$$



Divide by the denominator.

If the numerator is greater than 1, divide by the denominator and multiply by the numerator.

$\frac{3}{4}$ of £240

$$£240 \div 4 = £60$$

$$£60 \times 3 = £180$$



Divide by the denominator.

Multiply by the numerator.

Worked example

1 Work out: (a) $\frac{1}{4}$ of £80

$$£80 \div 4 = £20$$

(b) $\frac{2}{5}$ of 20 cm

$$20 \text{ cm} \div 5 = 4 \text{ cm}$$

$$4 \text{ cm} \times 2 = 8 \text{ cm}$$

Divide by 5 to find $\frac{1}{5}$, then multiply by 2 to find $\frac{2}{5}$

Worked example

2 Simon wants to buy a table that he has seen on sale in two different shops.



He wants to pay the least amount of money. From which shop should he buy the table? Give your reasons.

Table World

$\frac{1}{2}$ of £140

$$£140 \div 2 = £70$$

Discount Furniture

$\frac{2}{5}$ of £150

$$£150 \div 5 = £30$$

$$£30 \times 2 = £60$$

Simon should buy his table at Discount Furniture as it has the cheapest price.

Problem solved!

Remember to show all of your working clearly so that the reasons for your decision are clear.

- ✓ Work out how much the table costs at each store.
- ✓ Show your working out for each store clearly.
- ✓ Check your calculations to make sure you haven't made a mistake.
- ✓ Make a decision based on your calculations. Write a sentence to explain your reasons.

Now try this

1 Work out:

(a) $\frac{1}{5}$ of £70 (b) $\frac{2}{5}$ of £70 (c) $\frac{2}{3}$ of 48 g

2 Which is smaller, $\frac{4}{9}$ of £72 or $\frac{3}{4}$ of £44?

Use your answer to part (a) to help with part (b).

Word problems with fractions

When you are solving problems, you need to:

- ✓ read the question
- ✓ check your answers
- ✓ decide which calculation you are going to use
- ✓ make sure you have answered the question asked.

Worked example

- 1 A theatre had 240 tickets for a show.
On Saturday, it sold $\frac{2}{3}$ of the tickets.
On Sunday, it sold $\frac{1}{4}$ of the tickets.
How many tickets were sold altogether?

Saturday

$$\frac{2}{3} \times 240 = 240 \div 3 \times 2 = 160$$

Sunday

$$\frac{1}{4} \times 240 = 240 \div 4 = 60$$

Total ticket sales

$$160 + 60 = 220$$

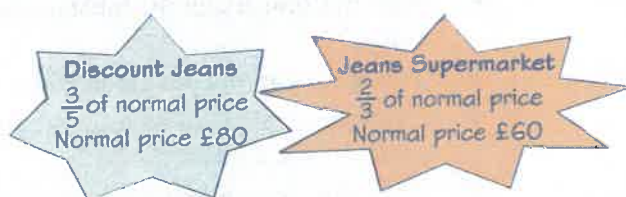
Problem solved!

Plan your strategy before you start.
Break the problem down into steps and lay your work out clearly.

- ✓ Work out the ticket sales for Saturday.
- ✓ Work out the ticket sales for Sunday.
- ✓ Work out the total sales for Saturday and Sunday.

Worked example

- 2 Nathaniel wants to buy some jeans.
He sees the same pair advertised in two different shops.



He wants to pay the least amount of money.
From which shop should he buy the jeans? Give your reasons.

Discount Jeans

$$\frac{3}{5} \text{ of } £80$$

$$£80 \div 5 = £16$$

$$£16 \times 3 = £48$$

Jeans Supermarket

$$\frac{2}{3} \text{ of } £60 = £60 \div 3 = £20$$

$$£20 \times 2 = £40$$

Nathaniel should buy his jeans at Jeans Supermarket as it has the cheapest price.

Problem solved!

Remember to show all your working clearly so that the reasons for your decision are clear.

- ✓ Nathaniel wants to pay the least amount of money, so you need to work out how much the jeans cost at each shop.
- ✓ Show your working out for each shop clearly.
- ✓ Check your calculations to make sure you haven't made a mistake.
- ✓ Make a decision based on your calculations. Write a sentence to explain your reasons.

Now try this

David buys 80 boxes of chocolates for £200. He sells $\frac{3}{4}$ of the chocolates for £4 each. He then sells the remaining chocolates for £2 each. Work out the total profit that David makes.

Decimals

You will need to be able to order decimals in lots of different types of questions including ordering money, ordering lengths and ordering weights.

Place value diagrams

You can use a place value diagram to help you understand and compare decimal numbers. Remember that decimal numbers with more digits are not necessarily bigger. Try writing extra zeros so that all the numbers have the same number of decimal places.

units		tenths	hundredths	thousandths
0	.	7	5	8
0	.	7	6	0
0	.	7	9	0
0	.	8	0	0

The value of 5 in this number is 5 hundredths.

0.76 is the same as 0.760

0.760 is bigger than 0.758 because 6 hundredths is bigger than 5 hundredths.

0.79 is smaller than 0.8 because the digit in the tenths place is smaller.

Worked example

1 Write down the value of the digit 4 in:

- (a) 2.46 4 tenths
(b) 32.843 4 hundredths
(c) 9.354 4 thousandths

2 Which of these numbers is larger?

- (a) 0.042 or 0.402 0.402
(b) 1.003 or 1.03 1.03

3 A carpenter has some lengths of wood. Order the lengths from smallest to largest.

0.63 m, 0.063 m, 0.306 m, 0.36 m, 0.036 m

0.036 m, 0.063 m, 0.306 m, 0.36 m, 0.63 m

Start from the largest place value. The units are the same.

units		tenths	hundredths	thousandths
0	.	0	4	2
0	.	4	0	2
1	.	0	0	3
1	.	0	3	

4 tenths is larger than 4 hundredths.

3 hundredths is larger than 3 thousandths.

The units are the same.

Compare the digits in each place value position.

Now try this

1 For each pair of numbers, decide which number is larger.

- (a) 6.7 and 6.456 (b) 23.819 and 23.84 (c) 2.03 and 2.003

2 What is the value of the 6 in these numbers?

- (a) 42.036 (b) 2.603

3 A beauty wholesalers sells shampoo by the litre. Here are the prices for four brands of shampoo. Order the amounts from smallest to largest.

£12.30 £12.03 £13.02 £10.30

Decimal calculations

You need to be able to add and subtract decimals up to 2 decimal places. You may need to convert money from pence to pounds before using your calculator.

Worked example

- 1 Here is a price list for a cafe.

Cup of coffee	£1.10
Cup of tea	90p
Sandwich	£1.99
Biscuit	98p

- (a) Find the cost of a cup of tea and a sandwich.

$$0.90 + 1.99 = £2.89$$

- (b) Find the cost of a cup of coffee and a biscuit.

$$1.10 + 0.98 = £2.08$$

The cost of a cup of tea is in pence, and the cost of a sandwich is in pounds. You need to make sure the costs are in the same units before doing any calculations.

Method 1

The cost of a cup of tea is 90p which is the same as £0.90

$$0.90 + 1.99 = £2.89$$

Method 2

The cost of a sandwich is £1.99, which is the same as 199p.

$$90 + 199 = 289p$$

$$289p = £2.89$$

Worked example

- 2 Bus tickets cost the following amounts:

adult £1.52

child 65p

- (a) Work out the difference in price between the adult and child ticket.

$$£1.52 - £0.65 = £0.87$$

- (b) Work out the cost of an adult ticket and two child tickets.

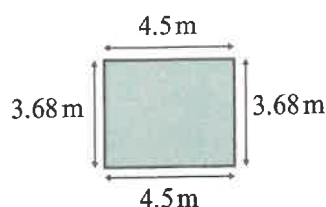
$$£1.52 + £0.65 + £0.65 = £2.82$$

Convert the child ticket price from pence into pounds so that both prices are in the same units.

To convert from pence to pounds, divide by 100.

Now try this

- Find the difference between £4.92 and 53p.
- What is the perimeter of this rectangle?



Add all four sides to work out the perimeter.

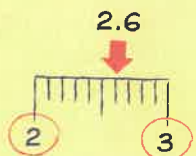
- 3 Oliver and Lukas go to the shops. They both write a list of how much they spend in each shop. Who spent more money in total?

Oliver	Lukas
£31.99	£29.01
80p	75p
£23.75	£26.89

Rounding decimals and estimating

Rounding decimals to whole numbers is useful when estimating the answer to a calculation. When you go shopping, you can estimate the total cost of your shopping bill by rounding the cost of each item to the nearest pound.

2.6 lies between 2 and 3



2.6 is closer to 3, so 2.6 rounds up to 3

Worked example

1 (a) The length of a car is 2.6m. Round this to the nearest metre.

2.6 rounded to the nearest whole number is 3 so the answer is 3 m

(b) In a shop a coat cost £68.50. Round this to the nearest pound.

68.50 rounded to the nearest whole number is 69 so the answer is £69

When the number is exactly halfway between the whole numbers, always round up

Using \approx

The \approx symbol means 'approximately equal to'. Use it when rounding and estimating.

Worked example

2 Work out an estimate for $7.92 - 2.43$

$$7.92 \approx 8$$

$$2.43 \approx 2$$

$$7.92 - 2.43 \approx 8 - 2 \approx 6$$

Round 7.92 and 2.43 to the nearest whole number.

Worked example

3 Here is Jacqui's shopping bill.

Estimate the total cost of her shopping.

$$3 + 5 + 5 + 2 = £15$$

£2.92

£5.31

£4.83

£2.42

Problem solved!

Show that you have rounded each value.

$$2.92 \approx 3$$

$$5.31 \approx 5$$

$$4.83 \approx 5$$

$$2.42 \approx 2$$

Use these values to find an estimate of the cost.

Now try this

1 Round these numbers to the nearest whole number.

(a) 4.2

(b) 15.74

(c) 9.8

2 Estimate the answer to:

(a) $3.7 + 8.2$

(b) $2.85 + 7.92 - 4.3$

Word problems with decimals

There are some methods you can use to help you solve different types of word problems.

Worked example

- 1 Simon is working out how much it will cost to decorate a room.
He needs 12 rolls of wallpaper and 5 litres of paste.
A roll of wallpaper costs £23.40
A litre of paste costs £3.24
He has a budget of £300. Does he have enough money to decorate the room?

$$12 \times £23.40 = £280.80$$

$$5 \times £3.24 = £16.20$$

$$£280.80 + £16.20 = £297$$

Yes, he does have enough to wallpaper the room.

Problem solved!

If you come across a tricky or unfamiliar question in your exam, you can try some of these methods:

- ✓ Try the problem with smaller or easier numbers.
- ✓ Set out your working clearly.
- ✓ Check your answer is sensible.
- ✓ Make sure you answer the question that was asked.

Worked example

- 2 Michael is organising a conference for 837 people.
Each person at the conference will be given a free pen.
The pens are sold in packs of 10 or 100
A pack of 10 pens cost £1.10
A pack of 100 pens cost £9.60
He wants to spend the smallest amount possible.
How much will he pay?

$$8 \times £9.60 = £76.80$$

$$4 \times £1.10 = £4.40$$

$$£76.80 + £4.40 = £81.20$$

Look at the combination of packs of pens that he needs to buy for 837 people.

He needs to buy:

8 packs of 100 pens = 800 pens and
4 packs of 10 pens = 40 pens

$$800 + 40 = 840 \text{ pens}$$

He will have 3 pens left over.

Now try this

- Joe buys a magazine that costs £4.45 and two birthday cards that cost £1.99 each. He pays with a £10 note. How much change will he receive?
- Lulu is packing a suitcase for her holiday. She can pack up to 19kg of luggage. Lulu's suitcase weighs 4.6kg. She wants to pack 11.3kg of clothing, 0.6kg of toiletries and 1.1 kilograms of electrical equipment. Can she pack a guidebook weighing 0.7 kg as well? Explain your answer.

Fractions and decimals

You can compare and order fractions by writing them as decimals.

Writing a fraction as a decimal

You can think of fractions as the numerator divided by the denominator:

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

To convert a fraction to a decimal, divide the numerator by the denominator.

Worked example

1 Write these fractions as decimals.

(a) $\frac{2}{25}$

$$2 \div 25 = 0.08$$

(b) $\frac{5}{16}$

$$5 \div 16 = 0.3125$$

Divide the numerator by the denominator. You can use your calculator to help you.

Worked example

2 The weights of some parcels are listed below.

Order the weights from smallest to largest.

$$1\frac{2}{5} \text{ kg} \quad 2\frac{1}{3} \text{ kg} \quad 1\frac{3}{10} \text{ kg} \quad 2\frac{3}{5} \text{ kg}$$

$$1\frac{2}{5} \text{ kg} = 1.4 \text{ kg} \quad 2\frac{1}{3} \text{ kg} = 2.333... \text{ kg}$$

$$1\frac{3}{10} \text{ kg} = 1.3 \text{ kg} \quad 2\frac{3}{5} \text{ kg} = 2.6 \text{ kg}$$

From smallest to largest:

$$1.3 \text{ kg} \quad 1.4 \text{ kg} \quad 2.333... \text{ kg} \quad 2.6 \text{ kg}$$

$$1\frac{3}{10} \text{ kg} \quad 1\frac{2}{5} \text{ kg} \quad 2\frac{1}{3} \text{ kg} \quad 2\frac{3}{5} \text{ kg}$$

First, write the fractions as decimals.

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

$$\frac{2}{5} \text{ can be written as } 2 \div 5 = 0.4$$

$$\text{So } 1\frac{2}{5} = 1 + 0.4 \\ = 1.4$$

Next, order the decimals from smallest to largest.

Finally, write the fractions in order.

Now try this

1 Write these fractions as decimals:

(a) $\frac{4}{5}$ (b) $\frac{7}{20}$ (c) $\frac{8}{40}$ (d) $1\frac{9}{12}$

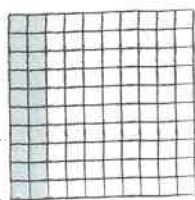
2 Which fraction is larger, $\frac{3}{8}$ or $\frac{4}{9}$?

3 Order these fractions from smallest to largest: $\frac{5}{8}$ $\frac{6}{8}$ $\frac{4}{10}$ $\frac{7}{16}$

Percentages

Percentages are useful when comparing proportions of different amounts.

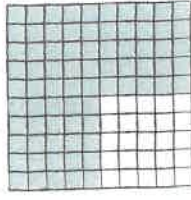
'Per cent' means 'out of 100'. A percentage can be written as a fraction with a denominator of 100.



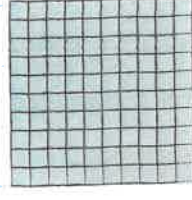
$$20\% = \frac{20}{100}$$



$$50\% = \frac{50}{100}$$



$$75\% = \frac{75}{100}$$



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

Worked example

Percentages of a whole always add up to 100%, so the sum of the percentage of students who pass and the percentage of students who fail must be 100%

- 1 At a driving school, 63% of students pass the driving test. The rest fail.

What percentage of students fail the test?

$$100\% - 63\% = 37\%$$

Worked example

- 2 Each week, Carla spends 25% of her income on rent, 37% on food and $\frac{11}{100}$ on entertainment. She saves the rest. What percentage of her income does Carla save?

$$25\% + 37\% + 11\% = 73\%$$

$$100\% - 73\% = 27\%$$

Problem solved!

- ✓ Add together the percentages of her income that Carla spends on rent, food and entertainment. $\frac{11}{100}$ is the same as 11 out of 100 or 11%
- ✓ Subtract the percentage of Carla's income that she spends each week from 100% to find the amount she saves.

Now try this

- 1 Claire took a maths test. She got 32 questions wrong and didn't answer a further 7 questions. She got the rest right. There were 100 questions in total. She needed 60% or more to pass the test. Did Claire pass the test? Explain your reasons.
- 2 The table shows the number of calls made by a team of salespeople and the number of people who bought a product during one weekend. The salespeople made 100 calls in total.

	Saturday	Sunday
Number of calls	44	56
Number of sales	21	34

- (a) What percentage of calls were made on Sunday?
- (b) Over the whole weekend, what percentage of calls did not result in sales?

Calculating percentage parts

You will be asked to solve problems where you need to work out percentages of an amount.

Finding a percentage of an amount

To find a percentage of an amount:

- 1 Divide the percentage by 100
- 2 Multiply the result by your amount.

For example, 12% of 80 cm is 9.6 cm:

$$12 \div 100 = 0.12$$

$$0.12 \times 80 \text{ cm} = 9.6 \text{ cm}$$

Worked example

- 2 Romesh books a holiday that costs £540 and pays a 15% deposit. How much has he left to pay?

$$15 \div 100 = 0.15$$

$$0.15 \times 540 = £81$$

$$£540 - £81 = £459$$

Worked example

- 1 Divya spends 24% of her wages on rent. She earns £2,000 per month. How much does she spend on rent?

$$24 \div 100 = 0.24$$

$$0.24 \times £2,000 = £480$$

Work out 15% of £540 then subtract this amount from £540 to work out what he still has left to pay.

Worked example

- 3 Jenny and Antonio are sorting eggs from their farm into boxes. They collect 130 eggs and 80% are large. The rest are medium.

(a) How many eggs are medium?

$$80 \div 100 = 0.8$$

$$0.8 \times 130 = 104$$

$$130 - 104 = 26 \text{ so } 26 \text{ eggs are medium.}$$

(b) Large eggs cost 40p each. Medium eggs cost 70% of the cost of large eggs. How much do medium eggs cost?

$$70 \div 100 = 0.7$$

$$0.7 \times 40\text{p} = 28\text{p}$$

Problem solved!

- ✓ Work out 80% of 130 eggs to find out how many are large.
- ✓ Subtract the number of large eggs from the total number of eggs to find out how many eggs are medium.
- (b) Work out 70% of 40p. Remember to include the correct units in your answer.

Now try this

- 1 In a race, the £640 prize money is to be shared by the contestants with the four fastest times. The winner gets 50%, second place gets 30% and third place gets 15%. Fourth place gets the remaining prize money. How much does each of the four contestants get?
- 2 There are 750 students in Castle Hill School. 56% study French. The rest of the students study German. How many students study German?

Fractions, decimals and percentages

You can arrange a list of fractions, decimals and percentages in order of size by changing them to the same type.

Converting between fractions, decimals and percentages

1

You can convert a decimal to a percentage by multiplying by 100.
 $0.37 = 37\%$

2

You can write any percentage as a fraction with denominator 100.
 $60\% = \frac{60}{100}$

3

You can convert a fraction to a decimal by dividing the numerator by the denominator.

$$\frac{3}{4} = 3 \div 4 = 0.75$$

Useful equivalents

Remember these common fraction, decimal and percentage equivalents.

Fraction	Decimal	Percentage
$\frac{1}{100}$	0.01	1%
$\frac{1}{10}$	0.1	10%
$\frac{1}{5}$	0.2	20%
$\frac{1}{4}$	0.25	25%
$\frac{1}{2}$	0.5	50%
$\frac{3}{4}$	0.75	75%

Worked example

Thomasina has a bag of jelly beans.
 15% of the jelly beans are strawberry flavoured.

$\frac{1}{4}$ of the jelly beans are pineapple flavoured.

$\frac{2}{5}$ of the jelly beans are apple flavoured.

The remaining jelly beans are cinnamon flavoured. What percentage of the jelly beans are cinnamon flavoured?

$$\frac{1}{4} = 25\%$$

$$\frac{2}{5} = 40\%$$

$$15 + 25 + 40 = 80$$

$$100 - 80 = 20$$

20% of the jelly beans are cinnamon flavoured.

Problem solved!

As the answer needs to be a percentage, convert the fractions to percentages.

All the jelly beans are 100% of the jelly beans. Work out the percentage of jelly beans that are **not** cinnamon flavoured.

Subtract your answer from 100% to find the percentage of jelly beans that are cinnamon flavoured.

Now try this

1 Write these numbers in order, starting with the smallest: 0.42 $\frac{2}{5}$ 36%

2 In a game, 5 players each put 12 counters on a table. Sasha wins 35% of the counters. Peter wins $\frac{2}{5}$ of the counters. Hayden wins the remaining counters. How many counters does Hayden win?

Write all three numbers in the same form, then compare them.

Word problems with percentages

When you are solving problems, you need to:

- ✓ read the question
- ✓ check your answers
- ✓ decide which calculation you are going to use
- ✓ make sure you have answered the question asked.

Worked example

- 1 Joseph owns a cafe. His customers can order a choice of two set meals.

One weekend, he has 80 customers. 20% of these customers order set meal A. The other customers order set meal B.

The table shows the cost of each set meal.

	Cost
Set meal A	£12
Set meal B	£15

How much money did Joseph's cafe take over the weekend?

set meal A:

$$20 \div 100 = 0.2$$

$$0.2 \times 80 = 16 \text{ people}$$

$$16 \times 12 = £192$$

total money earned:

$$192 + 960 = £1,152$$

set meal B:

$$80 - 16 = 64 \text{ people}$$

$$64 \times 15 = £960$$

Problem solved!

- ✓ Work out the number of people that ordered set meal A by finding 20% of 80
- ✓ Work out the number of people that ordered set meal B by subtracting the number of people who ordered set meal A from 80
- ✓ Work out the total money earned for set meal A and set meal B.
- ✓ Add the money earned from set meal A and set meal B to get the total money earned.

Worked example

- 2 A hotel did a survey to check customer satisfaction. In March, 6 out of 10 people said they found the services excellent.

In April, 3 out of 5 people said they found the services excellent.

Which month had the higher percentage of excellent responses?

March

$$\frac{6}{10} = 6 \div 10 \times 100$$

$$= 60\%$$

April

$$\frac{3}{5} = 3 \div 5 \times 100$$

$$= 60\%$$

They both had the same percentage of excellent responses.

Now try this

In one week, 150 people visited a sports centre. 30% used the gym, 20% used the swimming pool and the rest went to fitness classes. The cost of each of the activities is given in the table.

How much did the sports centre make in the week?

Activity	Cost
gym	£5
swimming pool	£6
fitness classes	£8

Using formulas

A formula is a mathematical rule that lets you calculate one quantity when you know the others.

Substituting values into formulas

To use a formula, substitute the values you know and then work out the answer. Remember to follow the correct order of operations.

Order of operations

Remember to use the correct order of operations when you are doing a calculation.

First, complete any calculations in brackets. Then do any division and multiplication.

Then do any addition and subtraction.

Worked example

- 1 The formula connecting speed to distance and time is: $\text{speed} = \text{distance} \div \text{time}$

Calculate the speed of a car that travels 200 km in 4 hours.

$$\begin{aligned}\text{speed} &= 200 \text{ km} \div 4 \text{ hours} \\ &= 50 \text{ km/h}\end{aligned}$$

Problem solved!

- ✓ Substitute the numbers into the formula.
- ✓ Check you have included the correct units.
- ✓ Check your answer makes sense.

Worked example

- 2 You can use this formula to work out the cooking time in minutes for a turkey:

$$\text{cooking time} = \text{weight in kg} \times 30 + 45$$

Work out the cooking time for a turkey weighing 7 kg.

$$\begin{aligned}\text{cooking time} &= 7 \times 30 + 45 \\ &= 210 + 45 \\ &= 255 \text{ minutes}\end{aligned}$$

Substitute the weight into your formula before you do any calculations.

Remember to use the correct order of operations. You multiply before you add.

Now try this

Dogs age faster than humans. The formula for working out the age of a dog in dog years is:

$$\text{dog years} = 21 + 4.5 \times \text{human years}$$

Find the age of a dog that has been living for 10 human years.

Ratio

Ratios are used to compare quantities.

Writing ratios



Out of 4 pieces of fruit, there are 3 apples and 1 orange. The ratio of apples to oranges is 3 : 1

The sum of the two parts of this ratio is the number of items there are in total.

$$3 + 1 = 4$$

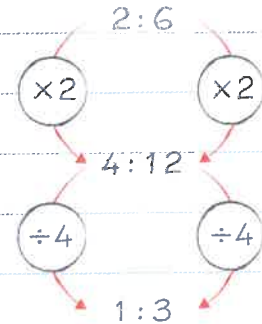
Equivalent ratios

You can find equivalent ratios by multiplying or dividing by the same number.

Simplest form

The simplest form of a ratio is the equivalent ratio with the smallest possible whole number values.

The ratio 1 : 3 is in its simplest form.



Worked example

Write each ratio in its simplest form.

- (a) A garment label says 80% cotton 20% acrylic. What is the ratio of cotton to acrylic?

$$\begin{aligned} \text{cotton : acrylic} &= 80 : 20 \\ &= 4 : 1 \end{aligned}$$

- (b) A recipe uses 250 g of flour to 50 g of butter. What is the ratio of flour to butter?

$$\begin{aligned} \text{flour : butter} &= 250 : 50 \\ &= 5 : 1 \end{aligned}$$

Write the ratios in the order they are given.

Simplify the ratios fully.

Divide 80 and 20 by 20

$$80 : 20 = 4 : 1$$

Divide 250 and 50 by 50

$$250 : 50 = 5 : 1$$

You can also simplify in stages.

$$80 : 20 = 8 : 2 = 4 : 1$$

$$250 : 50 = 25 : 5 = 5 : 1$$

Now try this

- A bag contains green and red cherries in the ratio 1 : 4. Another bag contains green and red cherries in the ratio 3 : 15. Are these equivalent ratios? Explain your reasons.
- Verity got 12 out of 16 in a test. She says that the ratio of correct to incorrect answers is 4 : 1. Explain why she is wrong.

Ratio problems

You will need to use ratios to solve problems in different contexts.

Worked example

- 1 An electrician spent 30 minutes travelling to a client and 2 hours working for them.

Write the ratio of travel time to working time in its simplest form.

$$2 \text{ hours} = 2 \times 60 = 120 \text{ minutes}$$

travel time : working time

$$30 : 120$$

$$1 : 4$$

You must make sure the ratios are in the same units before simplifying.

Either convert hours to minutes or minutes to hours.

Divide both parts of the ratio by 30 to get it in its simplest form.

Worked example

- 2 Jesse and Simone are buying a new computer.

They divide the cost in the ratio 1 : 3

Jesse pays £97.

How much more does Simone pay?

$$3 \times £97 = £291$$

$$£291 - £97 = £194$$

Simone pays £194 more than Jesse.

Jesse's name comes first so the first number in the ratio refers to the amount he pays.

Jesse pays £97 and Simone pays three times as much. Multiply Jesse's share by 3 to find out how much Simone pays. Then subtract £97 from that amount to find the difference.

Now try this

- To make meringue, John whisked 80 g of egg white with 240 g of sugar. What was the ratio of egg white to sugar? Write the ratio in its simplest form.
- Tamal gives away a proportion of his wages to two charities. He donates money to a local food bank and a medical research charity in the ratio 3 : 1. Last year he gave away £990 to the food bank. How much did he give to the medical research charity?

Proportion

When two quantities are in direct proportion, they both increase or decrease at the same rate.

Money problems

Direct proportion problems often involve money. You can sometimes solve problems by working out the cost of **one item**.

If 3 theatre tickets cost £135:

1 theatre ticket costs $£135 \div 3 = £45$

9 theatre tickets cost $9 \times £45 = £405$

Worked example

- 1 Suresh buys 4 picture frames for a total cost of £11.40

Work out the cost of 7 of these picture frames.

$$\begin{aligned} \text{Cost of 1 frame} &= £11.40 \div 4 \\ &= £2.85 \end{aligned}$$

$$\begin{aligned} \text{Cost of 7 frames} &= £2.85 \times 7 \\ &= £19.95 \end{aligned}$$

Calculate the cost of 1 picture frame first. Then multiply the cost of 1 frame by 7 to work out the cost of 7 frames. When you are working with money you should:

- do all your calculations in either pounds or pence
- write answers in pounds to 2 decimal places.

Worked example

- 2 A garden centre sells large and small plants.

- (a) 15 large plants cost £75. How much will 11 large plants cost?

$$75 \div 15 = 5$$

$$11 \times 5 = 55$$

11 large plants will cost £55

Work out how much 1 plant costs.

Multiply that amount by 11

Make sure you give units with your answer.

- (b) Small plants are available in trays of 6 or boxes of 10

tray of 6
£15

box of 10
£24

Work out whether the box or the tray offers better value.

tray

$$15 \div 6 = 2.5$$

£2.50 per plant

box

$$24 \div 10 = 2.4$$

£2.40 per plant

£2.40 < £2.50 so the box is better value.

Work out the cost of each plant in a tray of 6 and in a box of 10. Write a short conclusion saying which one is better value.

Now try this

Lydia buys 8 identical bottles of water for a total cost of £4.48

Work out:

- (a) the cost of 5 bottles of water.

- (b) the cost of 12 bottles of water.

Recipes

A recipe will give the amount of ingredients for a certain number of people. Sometimes you will need to adjust the amount of ingredients to make enough for a different number of people.

You can use direct proportion to calculate the correct quantity of ingredients.

Worked example

- 1 A recipe for biscuits uses 100 g of butter to make 8 biscuits.

How many grams of butter would you need to make 24 biscuits?

$$24 \div 8 = 3$$

$$100 \text{ g} \times 3 = 300 \text{ g}$$

Divide 24 by 8 to find out how many lots of the recipe you need to make.

Number of biscuits	Butter
8	100 g
24	300 g

Worked example

- 2 This list of ingredients makes enough pizza to serve 6 people.

400 g bread dough

120 ml tomato puree

240 g grated cheese

Jonathan has 1200 g of bread dough, 300 ml of tomato puree and 800 g of grated cheese. Does he have enough ingredients to serve 18 people?

$$18 \div 6 = 3$$

Jonathan needs:

bread dough: $3 \times 400 \text{ g} = 1200 \text{ g}$

tomato puree: $3 \times 120 \text{ ml} = 360 \text{ ml}$

grated cheese: $3 \times 240 \text{ g} = 720 \text{ g}$

No, Jonathan does not have enough as he doesn't have enough tomato puree.

Divide the number of servings Jonathan needs by the number of servings the recipe makes to find out how many lots of the recipe he needs to make.

Work out the amount of ingredients for 18 people and compare to how much Jonathan has.

People	Bread dough	Tomato puree	Grated cheese
6	400 g	120 ml	240 g
18	1200 g	360 ml	720 g

Now try this

A recipe shows this list of ingredients to make vegetable soup for 4 people:
400 g of courgettes, 600 g of potatoes, 1000 ml stock

- (a) How many grams of potatoes are needed to make the soup for 8 people?
(b) Simon has 1600 g of courgettes, 2000 g of potatoes, 5000 ml of stock. Does he have enough ingredients to serve 16 people?

Make sure you clearly state 'yes' or 'no' in your answer and explain your decision.

Word problems with ratio

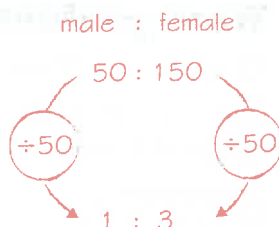
When solving problems, you need to make sure you have answered the question that has been asked. Always read the question carefully. Underlining the key information might help.

Worked example

- 1 A golf club has 200 members. 150 are female.

Work out the ratio of male to female members.

Give your answer in its simplest form.



number of male members = total number of members – number of female members

$$200 - 150 = 50 \text{ male members}$$

Problem solved!

- ✓ You need to write the ratio of males to females, so you need to find the number of males.
- ✓ Be careful with the order of the ratio.
- ✓ Check that the ratio has been simplified fully.

Worked example

- 2 Dan wants to buy some tiles for his kitchen. He needs a total of 800 blue tiles. For every 4 blue tiles he will need 1 white tile.

Packs of 10 blue tiles cost £12 and packs of 10 white tiles cost £9

How much will it cost him to tile his kitchen?

$$800 \div 4 = 200$$

Dan needs 800 blue tiles and 200 white tiles.

cost of blue tiles

cost of white tiles

$$800 \div 10 = 80$$

$$200 \div 10 = 20$$

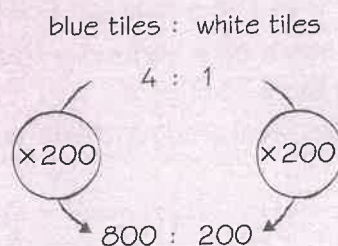
$$80 \times 12 = \text{£}960$$

$$20 \times 9 = \text{£}180$$

$$\begin{aligned} \text{Total cost of tiles} &= \text{£}960 + \text{£}180 \\ &= \text{£}1,140 \end{aligned}$$

Problem solved!

- ✓ Work out how many white tiles he needs. Ratio of blue tiles to white tiles is 4:1



- ✓ He buys the blue tiles and white tiles in packs of 10. Work out the number of packs of blue tiles and white tiles he needs.
- ✓ Work out the cost of the blue tiles and white tiles.
- ✓ Find the total cost of the tiles.

Now try this

A caterer is buying ingredients to make tuna sandwiches.

For every 5 bread rolls, he needs 1 tin of tuna. He has 40 bread rolls.

(a) How many tins of tuna does he need?

(b) A packet of 10 bread rolls costs £4 and a pack of 2 tins of tuna costs £3

How much will it cost him to make the 40 sandwiches?

Problem-solving practice

When you are solving problems, you need to:

- ☒ read the question
- ☒ check your answers
- ☒ decide which calculation you are going to use
- ☒ make sure you have answered the question asked.

1

On a weekday, this is how much it costs to park on Barrington Road:

up to 2 hours	£3
2–4 hours	£8
more than 4 hours	£14

Amina needs to park her car for 3 hours on Wednesday, 1 hour on Thursday and 6 hours on Friday. She thinks it will cost less than £20. Is Amina correct?

(3 marks)

Word problems page 13

Read the question carefully.

Find out how much each day will cost Amina and add these amounts together.

TOP TIP

Make sure you answer the question that has been asked – to complete your answer you must write a statement to say whether or not Amina is correct.

2

Josie owns a furniture shop.

She buys 80 sofas to sell in her shop.

Josie pays £200 for each sofa.

She sells $\frac{3}{4}$ of the sofas for £300 each.

She then has a sale and sells the rest of the sofas for £250 each.

What is the total amount Josie makes?

(4 marks)

Word problems with fractions page 18

Work out how much Josie pays for the sofas. You need to work out how many sofas she sells for £300 and how many sofas she sells for £250

TOP TIP

Plan how to lay out your answer. You need to show what you are working out at each stage, so it might help to use headings.

3

Joe's cafe

coffee	£2.25
tea	£1.75
squash	99p
soup	£3.60
bread roll	80p
sandwich	£3.05

Zhara buys 4 coffees, 2 teas, 3 squashes, 4 soups, 5 sandwiches and 2 bread rolls. She pays with two £20 notes and a £10 note. How much change should she get?

(3 marks)

Word problems with decimals page 22

Work out the cost of 4 coffees, 2 teas, and so on. Then add up the totals to work out Zhara total bill. Work out how much Zhara gives the cashier. Finally, subtract to find her change.

TOP TIP

Remember to do all your calculations in either pounds or pence.

Problem-solving practice

4

In 2010, a business used 1800 reams of paper. In 2011, the same business used 20% more paper.

How many reams of paper did the business use altogether in 2011?

(4 marks)

Calculating percentage parts page 25

First work out 20% of 1800, then add this to 1800 to find out how much paper was used in total.

TOP TIP

Check if your answer is sensible.

5

A holiday company asked its customers to rate a hotel. 70% of customers said that the hotel was excellent. 1 out of 5 customers said the hotel was satisfactory.

The rest were unhappy with the hotel.

What percentage of customers were unhappy with the hotel?

(2 marks)

Fractions, decimals and percentages page 26

Convert 1 out of 5 to a percentage.

Add this to 70% and subtract the total from 100%.

TOP TIP

Check your working. All the percentages should add up to 100%.

6

A flat-packed furniture company is packing door handles and screws for each of its cupboards.

For every cupboard, there need to be 4 screws and 2 door handles. There are 30 cupboards.

(a) How many screws are needed?

(1 mark)

(b) The cost price of 10 screws is £2 and the cost price of 5 door handles is £20

How much would the cost price be for the handles and screws of the 30 cupboards?

(3 marks)

Word problems with ratio page 33

(a) Notice that the cupboards and screws are in direct proportion.

(b) • Work out the number of screws and door handles needed to make 30 cupboards.

• Work out the number of packs of screws and door handles needed.

• Work out the cost.

TOP TIP

In the online test, if you get stuck, you can flag a question to come back to later.

Click the review button so that you can check that question again.



Problem-solving practice

7

Johanna needs to hire a car from Monday to Friday.

The formula below calculates the cost of hiring a car:

Cost (£) = £40 + number of days × £25

She has a budget of £150. Will she have enough money to hire the car?

(3 marks)

Using formulas page 28

- Work out the number of days Johanna needs to hire the car for.
- Substitute the numbers into the formula.
- Check your numbers are in the correct units.

TOP TIP

Check whether or not your answer is sensible.

8

A shop sells packets of crisps. It has two offers.

offer A

12 packets for
£4.32

offer B

18 packets for
£6.30

Which offer is the best value for money?

(3 marks)

Proportion page 31

- Work out the cost of each packet of crisps for offer A.
- Work out the cost of each packet of crisps for offer B.
- Write a short conclusion saying which one is better value.

TOP TIP

Make sure you compare both costs in the same units. You can either use pounds or pence.

9

This recipe shows the list of ingredients to make scones for 8 people:

Ingredients

240 g self-raising flour
1 tsp baking powder
80 g butter
160 ml milk

Claire has:

500 g self-raising flour
3 tsp baking powder
200 g butter
300 ml milk

Does she have enough ingredients to make scones for 16 people?

(3 marks)

Recipes page 32

Work out the amount of each ingredient Claire will need to make scones for 16 people.

TOP TIP

Use the onscreen calculator to do your calculations.

Show your working clearly so that you can answer the question with reasons.