Adding and Subtracting

You Need to Know When to Add or Subtract

1) The questions you get in your assessment will be based on real-life situations.
2) You won't always be told whether to add or subtract (take away).
3) You'll need to work out for yourself what calculation to do.

Example 1

Joe is booking a holiday. Everything he has to pay for is shown below. He gets £50 off the total cost of his holiday for booking online.

How much will the holiday cost Joe?

Flights	£299
7 nights in a 4* hotel	£345
Airport transfers	£40

Step 1 — add up the prices of the flights, hotel and airport transfers:

$299 + 345 + 40 = £684$ ← Use a calculator to work this out. You'll be able to take a calculator into the test and use it whenever you need to.

Step 2 — take away £50 from your answer:

$$684 - 50 = £634$$

Sometimes you need to include units in your answer. Units tell you what type of number you've got. In this case the units are '£'.

Example 2

Kerry has £400. She needs to pay £110 in council tax and £246 for her electricity bill. She also wants to buy a new coat for £50.

Will Kerry have enough money left for the coat once she has paid her bills? Explain your answer.

You need to take away £110 and £246 from £400, then see how much is left.

$$400 - 110 - 246 = £44$$

Kerry only has £44 left once she has paid her bills so, no, she doesn't have enough money left for the coat.

Always Check Your Answer

1) Adding and subtracting are opposite calculations.

2) Once you've got your answer, you can check it using the opposite calculation.

3) You should get back to the number you started with.

Example 1

What is 456 – 334? Answer: 456 – 334 = 122

Check it using the opposite calculation: 122 + 334 = 456

Example 2

What is 92 + 25?

Answer: 92 + 25 = 117

You only need to do one of these calculations to check your answer.

Check it using the opposite calculation: 117 – 25 = 92 OR 117 – 92 = 25

Practice Questions

1) 7643 people went to a football match in Manchester. 6391 people went to a football match in Glasgow. How many people went to these two football matches in total?

.....

2) 250 people work for PFC textiles. 96 are women. How many are men?
Show how you can check your answer.

.....

.....

3) Zainab buys a dress for £36 and a new pair of shoes for £28. She has a voucher for £5 off her final bill. How much does Zainab spend using the voucher?

.....

.....

4) Doug gets 25 days of holiday each year. He used 6 days of holiday at Christmas and 4 days at Easter. He wants to take 10 days for his summer holiday.
Does he have enough holiday left? Explain your answer.

.....

.....

Multiplying and Dividing

You Need to Know When to Multiply or Divide

You'll get questions where you need to multiply or divide.
You need to be able to work out what calculation to do for yourself.

Example 1

Jan needs to buy 100 large envelopes at 76p each.
How much money does she need?

Answer: each envelope costs 76p. So you need to work out 100 times 76.

$$100 \times 76 = 7600\text{p or } £76.00$$

Example 2

A pub quiz team has five players. The team wins £40 prize money, to be split equally between the players. How much will each player be given?

Answer: the £40 has to be divided between 5 players.
So you need to divide 40 by 5.

$$40 \div 5 = £8$$

Always Check Your Answer

1) Multiplying and dividing are opposite calculations.
2) Once you've got your answer, you can check it using the opposite calculation.
3) You should get back to the number you started with.

Example

What is 32×9?

Answer: $32 \times 9 = 288$

Check it using the opposite calculation: $288 \div 9 = 32$ OR $288 \div 32 = 9$

Using a Calculator

Calculations with Several Steps

1) You'll sometimes need to do calculations that have several steps.
2) You could work out each step separately or you could type the whole thing into your calculator in one go.
3) BUT you need to be careful about how you type things into your calculator.

Some Calculators Use Brackets (...)

1) Some calculators use brackets to help them work out calculations with several steps.
2) The brackets tell the calculator to work out the bits inside the brackets before it does the rest of the calculation.
3) Without them, the calculator does the calculation in the wrong order — and you get the wrong answer.

Example

Claire works for 4 hours a week in a shop. She works for 6 hours a week in a nursery. How many hours does Claire work in total in 4 weeks?

1) You could work out the total number of hours Claire works in a week, then times this by 4.

   Total number of hours Claire works in a week = 4 + 6 = 10

   Total number of hours Claire works in 4 weeks = 10 × 4 = **40 hours**

2) You could also do the whole calculation in one go on your calculator.

   But if you type in '4 + 6 × 10', you might get the wrong answer.

   If so, your calculator probably uses brackets.

   You need to tell the calculator to work out the total number of hours a week Claire works first, then times this by 4.

   So you need to put 4 + 6 in brackets:

   $$(4 + 6) \times 4 = 40 \text{ hours}$$

   Brackets always come in pairs.

Calculators Without Brackets

Not all calculators use brackets. You still need to be careful about how you type calculations into your calculator though.

Example

What is 22 divided by the total of 5 + 6?

1) Work out what 5 + 6 is first, then divide 22 by this number: $5 + 6 = 11$

$22 \div 11 = \mathbf{2}$

2) If you just type '22 ÷ 5 + 6' into your calculator, you'll get the wrong answer:

$22 \div 5 + 6 = 10.4$

So, if your calculator doesn't have bracket buttons, it's best to work out each step of the calculation separately.

If your calculator doesn't have bracket buttons and you're given a calculation that has brackets in, just work out the bits in brackets first.

Example

What is $36 \div (3 \times 4)$?

1) Work out the bit in brackets first: $3 \times 4 = 12$

2) Put this answer into the calculation instead of the brackets: $36 \div 12 = \mathbf{3}$

Practice Questions

1) What is $12 \div (2 \times 3)$?

.....

2) What is $(11 \times 24) \div (4 \times 3)$?

.....

3) What is $(102 \div 3) \div (50 \div 25)$?

.....

4) Omar drives 10 miles to work every day. He drives 11 miles home to avoid traffic. He does this 5 days a week. How far does Omar drive in a week?

.....

.....

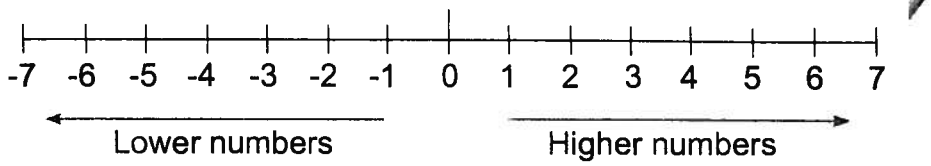
The Number Line and Scales

Negative Numbers are Less than Zero

1) A negative number is a number less than zero.

2) You write a negative number using a minus sign (-). For example, -1, -2, -3.

3) A number line is really useful for understanding negative numbers.



All negative numbers are to the left of zero.

All positive numbers are to the right of zero.

The further right you go, the higher the numbers get.
For example, -2 is higher than -7.

Use a Number Line to Work Out Differences

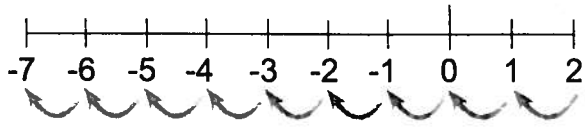
You can use a number line to work out the difference between two numbers.
For example, the difference between a positive number and a negative number.

Example

A fridge is 2 °C. A freezer is -7 °C. What is the difference in temperature between the fridge and the freezer?

1) Draw a number line that includes both the numbers in the question.

2) Count back from 2 to -7 °C.



There are 9 steps, so the difference in temperature is 9 °C.

Practice Questions

1) A test has negative marking. Ian scores -2. Jess scores -14. Who has the lowest score?

.....

.....

2) Rachael has -£346 in her bank account. Larry has -£334 in his bank account.

a) Who has less money in their account?

.....

.....

b) Rachael is given £15. How much money does she now have in her account?

.....

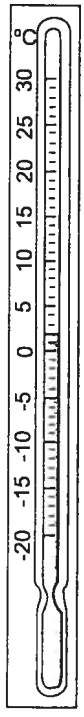
3) The temperature in Moscow -8 °C. In Berlin it is 4 °C.
What is the difference between these two temperatures?

.....

.....

A Scale is a Type of Number Line

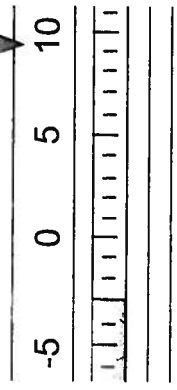
1) You might be asked to read a scale.
For example, to read the temperature off a thermometer.



2) Scales are just number lines.
They don't always show every number though.

Example 1

This is part of a thermometer.
It shows the temperature in °C.



What temperature is it?

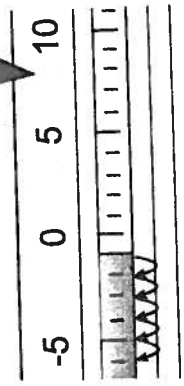
Answer:

There are 4 lines between 0 and -5.
So each line must be worth 1 °C.

It is -3 °C.

Example 2

This is part of a thermometer.
It shows the temperature in °C.



What would the thermometer read if the temperature dropped by 5 °C?

Answer:

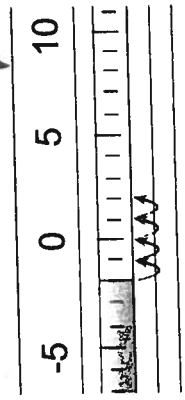
1) Work out what the thermometer reads now.

2) Count down 5 places.

The thermometer would read -6 °C.

Example 3

This is part of a thermometer.
It shows the temperature in °C.



What would the thermometer read if the temperature increased by 4 °C?

Answer:

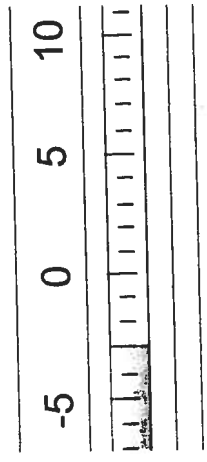
1) Work out what the thermometer reads now.

2) Count up 4 places.

The thermometer would read 2 °C.

Practice Questions

Every day, Pat records the temperature in his garden. The temperature (in °C) that he records at 7 am is shown on the thermometer on the right.



1) What temperature is shown on the thermometer?

.....

2) By 12 pm, Pat notices that the temperature has increased by 6 °C. By 4 pm, it has dropped by 2 °C. What temperature is it at 4 pm?

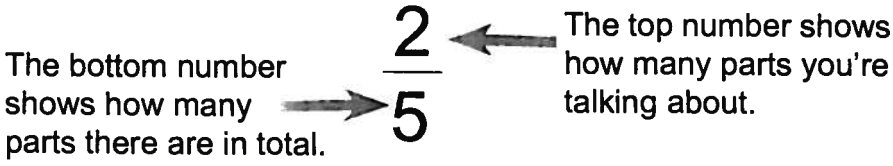
.....

Fractions

Fractions Show Parts of Things

1) If something is divided up into equal parts, you can show it as a fraction.

2) There are two bits to every fraction:



Example

A pizza is cut into 9 slices. 2 slices are eaten.
What fraction of slices were eaten?

2 out of the 9 slices were eaten, so it's $\frac{2}{9}$ (you say 'two ninths').

Learn How to Write Fractions

Here's how to write some common fractions:

One half = $\frac{1}{2}$ One third = $\frac{1}{3}$

One quarter = $\frac{1}{4}$ Three quarters = $\frac{3}{4}$

Practice Question

) 13 people take their driving test on the same day. 9 pass.

a) What fraction of people passed?

.....

b) What fraction of people failed?

.....

'Of' means 'times'

1) Sometimes, you might need to calculate a 'fraction of' something.

2) In these cases, 'of' means 'times' (multiply).

Example 1

What is $\frac{1}{8}$ of 64?

1) 'Of' means 'times' (×), so $\frac{1}{8}$ of 64 is the same as $\frac{1}{8} \times 64$.

2) You type fractions into your calculator by dividing the top by the bottom.

So $\frac{1}{8} = 1 \div 8$

3) The overall calculation you need to do is: $1 \div 8 \times 64 = 8$

Example 2

A survey asks 96 people whether they are satisfied with their job.
A third of the people asked say 'no'. How many people say no?

You need to calculate one third of 96.

1) 'Of' means 'times' (×), so $\frac{1}{3}$ of 96 is the same as $\frac{1}{3} \times 96$.

2) $1 \div 3 \times 96 = 32$ So 32 people said no.

Practice Questions

1) What is $\frac{1}{4}$ of 48? .....

2) What is $\frac{2}{11}$ of 55? .....

3) A hair salon has 24 clients booked in for the week.

a) One sixth of the clients cancel their appointments. How many clients cancel?

.....

b) Of the remaining clients, two fifths are booked in for a cut and colour.
How many clients are booked in for a cut and colour?

.....

.....

Discounts Involving Fractions

You might need to calculate a fraction of a price to work out a discount price.

Example 1

A coat usually costs £75. In the sale, it's half price.
What is the sale price of the coat?

This is just like saying that the coat costs 'half of £75' in the sale.

So you need to work out: $\frac{1}{2} \times 75$

$1 \div 2 \times 75 = £37.50$ So the sale price of the coat is **£37.50**.

Sometimes you need to add or subtract a fraction of a price to work out the discount price.

Example 2

A cruise usually costs £1200. A special offer gives two thirds off the price.
What is the special offer price of the cruise?

1) First you need to work out two thirds of £1200.
This is the same as $\frac{2}{3} \times 1200$.
$2 \div 3 \times 1200 = £800$ So the special offer gives £800 off the cruise.

2) Then you need to take this number away from £1200: $1200 - 800 = £400$
So the special offer price is **£400**.

Practice Questions

A pair of boots normally cost £40 but are half price in the sale. How much do they now cost?

.....

A fast food chain has reduced the size of their burgers. Each burger used to weigh 540 g. They're now a third smaller. What does each burger weigh now?

.....

.....

A fitted kitchen costs £2000. The price is reduced by a quarter in the sale.
The new price is then reduced by a third. How much does the kitchen now cost?

.....

.....

.....

Mixed Fractions

Mixed Fractions

1) Mixed fractions are when you have whole numbers and fractions together.
For example, $1\frac{1}{4}$ (one and a quarter).

2) You can enter a mixed fraction into your calculator by typing in the fraction first, and then adding the whole number.

Example

To enter $1\frac{1}{4}$, type in: 1 ÷ 4 + 1 = 1.25 ← This gives you the fraction as a decimal. See page 16 for more on decimals.

Calculations Involving Mixed Fractions

You might get asked to do a calculation involving a mixed fraction.

Example 1

What is $5\frac{1}{2} \times 4$?

1) Start by entering $5\frac{1}{2}$ into your calculator: → 1 ÷ 2 + 5 = 5.5

2) Then multiply your answer by 4: → 5.5 × 4 = **22**

Example 2

Dee is picking apples. She picks 9 kg of apples and puts them into crates. Each crate weighs $1\frac{1}{2}$ kg when full. How many crates does Dee use?

Answer:

You need to divide the total weight of apples by the weight of a crate: $9 \div 1\frac{1}{2}$.

1) Enter $1\frac{1}{2}$ into your calculator: → 1 ÷ 2 + 1 = 1.5

2) Then divide 9 by this number: → 9 ÷ 1.5 = 6

So Dee needs to use **6 crates**.

If your calculator has brackets, you can do this calculation in one go.
Just press: 9 ÷ (1 ÷ 2 + 1) = 6

Example 3

Fiona is driving from Penrith to Manchester.
She needs to stop at Kendal on the way to pick up her friend Steve.

The journey from Penrith to Kendal will take half an hour.
The journey from Kendal to Manchester will take $1\frac{1}{2}$ hours.

How long will the journey take in total?

Answer: you need to add together $\frac{1}{2}$ hour and $1\frac{1}{2}$ hours.

1) Enter the $1\frac{1}{2}$ into your calculator: → 1 ÷ 2 + 1 = 1.5

2) Then add the $\frac{1}{2}$: → 1 ÷ 2 + 1.5 = 2 hours

If your calculator has brackets, you can do this calculation in one go.
Just press: (1 ÷ 2) + (1 ÷ 2 + 1) = 2 hours

Practice Questions

1) What is $6\frac{1}{4} \times 3$? .....

2) What is $9\frac{1}{2} \div 2$? .....

3) Harry wants to take the train from Barrow to Carlisle. A direct train will take $2\frac{1}{2}$ (2.5) hours.
If Harry changes at Lancaster, it will take 1 hour to get from Barrow to Lancaster and $\frac{3}{4}$ of an hour to get from Lancaster to Carlisle.
He'll also have to wait for $\frac{1}{2}$ an hour in Lancaster station.
Is it quicker for Harry to get the direct train or change at Lancaster? Explain your answer.

.....

.....

.....

.....

Decimals

Not All Numbers Are Whole Numbers

1) Decimals are numbers with a decimal point (.) in them. For example, 0.5, 1.3.

2) They're used to show the numbers in between whole numbers.

Examples

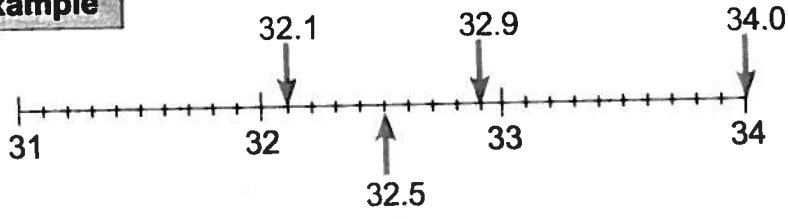
The number 32.1 is a bit bigger than the number 32.

The number 32.9 is a bit smaller than the number 33.

The number 32.5 is exactly halfway between the numbers 32 and 33.

3) You can show decimals on a number line.

Example



Rounding off Decimals

1) You can sometimes get an answer with lots of numbers after the decimal point.

2) Instead of writing down the whole thing, you can shorten the answer and only write down one or two numbers after the decimal point. This is called rounding off.

3) To round off you need to decide how many numbers you want after the decimal point.

4) Then you need to look at the next number along (the decider). If this is less than five you can just leave it off (and all the numbers after it) when you write down your answer.

Examples

1) Round 2.8427865 so that there are two numbers after the decimal point (this is called rounding to two decimal places).

You want two numbers after the decimal point, so the decider is the third number after the decimal point. The decider is 2, which is less than 5. So the answer is **2.84**

2) Round 10.341346786 to one decimal place.

You want one number after the decimal point, so the decider is the second number after the decimal point. The decider is 4, which is less than 5. So the answer is **10.3**

You May Need to Change the Last Number When Rounding

If the decider is 5 or more, then you need to add 1 to the last number when you round off.

Examples

1) Round 9.3186895 to two decimal places.

   You want two numbers after the decimal point, so the decider is the third number after the decimal point. The decider is 8, which is more than 5, so you need to add 1 to the last number.

   So the answer is **9.32**

2) Round 20.85373122 to one decimal place.

   You want one number after the decimal point, so the decider is the second number after the decimal point. The decider is 5, so you need to add 1 to the last number.

   So the answer is **20.9**

How to Put Decimals in Order

You might need to arrange a list of decimal numbers in order of size.

Example

Put these decimals in order of size: 1.22, 0.24, 0.06, 0.3.
Start with the smallest.

1) Put the numbers into a column, lining up the decimal points.
2) Make all the numbers the same length by filling in extra zeros at the ends.
3) Look at the numbers before the decimal point.
   Arrange the numbers from smallest to largest.
4) If any of the numbers are the same, move onto the numbers after the decimal point. Arrange the numbers from smallest to largest.

Step 1:		Step 2:		Step 3:		Step 4:
1.22		1.22		0.24		0.06
0.24		0.24		0.06		0.24
0.06	→	0.06	→	0.30	→	0.30
0.3		0.30		1.22		1.22

The order is: 0.06, 0.24, 0.3, 1.22.

Adding and Subtracting Decimals

1) You can add and subtract decimals using a calculator.

2) It's exactly the same as with whole numbers — just remember to type the decimal point into the calculator.

Example 1

Julie is a solicitor. She charges her clients by the hour. She works on a case for 2.5 hours on Monday, 1.25 hours on Tuesday and 0.75 hours on Wednesday. How many hours should she charge her clients for in total?

Answer: add together all the hours Julie has worked on the case.

2.5 + 1.25 + 0.75 = **4.5 hours**

Example 2

Clyde wants to know how much his sunflower has grown. It used to measure 1.45 m. It now measures 1.72 m. How much has it grown?

Answer: take away the first height (1.45 m) from the second height (1.72 m).

1.72 – 1.45 = **0.27 m**

Multiplying and Dividing Decimals

You can multiply and divide decimals in exactly the same way as whole numbers.

Example 1

Alwen is holding a charity event. She made £665.50 from ticket sales and sold 121 tickets. How much did each ticket cost?

Answer: divide the money made from the ticket sales by the number of tickets sold.

665.50 ÷ 121 = **£5.50**

Example 2

James earns £6.40 an hour and works 28.5 hours a week. How much money does he earn in a week?

Answer: multiply the amount James earns in an hour by the number of hours he works in a week.

6.40 × 28.5 = **£182.40**

Practice Questions

1) Round 3.57896 so that there is one number after the decimal point.

.....

2) Round 1.024 so that there are two numbers after the decimal point.

.....

3) Put these distances in order of size: 1.2 km, 1.75 km, 1.05 km, 1.25 km.
Start with the smallest.

.....

4) A gymnast needs 44 points or more to win a competition. She scores 14.7 in her first event, 15.2 in her second event and 13.9 in her third event. Does she have enough points to win? Explain your answer.

.....

.....

5) Tom has £262.98 in his bank account. He pays in a cheque for £56.23, then spends £39.47 on petrol and £41.42 in the supermarket. How much money is left in his account?

.....

.....

Jeremy works 37.5 hours a week. He needs to divide this time equally between two different projects. How many hours should he spend on each project?

.....

A company has 178 staff members. It costs the company a total of £142.40 to provide lunch for its staff. How much does the company spend on lunch per staff member?

.....

Rose buys 3 magazines for £1.75 each. She also buys 2 drinks for £1.32 each.
How much does she spend in total?

.....

.....

Percentages

Understanding Percentages

1) 'Per cent' means 'out of 100'.
2) % is a short way of writing 'per cent'.
3) So 20% means twenty per cent. This is the same as 20 out of 100.
4) You can write any percentage as a fraction. There's more on fractions on page 11.

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

Put the percentage on the top of the fraction.

Put 100 on the bottom of the fraction.

Calculating Percentages

1) Sometimes, you might need to calculate the 'percentage of' something.
2) In these cases, 'of' means 'times' (multiply).

Example 1

What is 30% of 96?

1) Write it down: 30% of 96
   ↓ ↓ ↓
2) Turn it into maths: $\frac{30}{100} \times 96$
3) Work it out: $30 \div 100 \times 96 = 28.8$

Example 2

A restaurant has 60 tables. 25% of the tables have been reserved. How many tables have been reserved?

1) Write it down: 25% of 60
   ↓ ↓ ↓
2) Turn it into maths: $\frac{25}{100} \times 60$
3) Work it out: $25 \div 100 \times 60 = 15$ tables

Practice Questions

1) What is 16% of 48?

.....

2) What is 40% of 660?

.....

3) A flight from London to Madrid has 300 passengers. 3% of the passengers are vegetarian. How many passengers are vegetarian?

.....

4) Asif is a dentist. He sees 75 patients in a week. Of these, 28% need to have a filling. How many patients need a filling?

.....

5) Lauren is buying a house for £98 000. She needs a deposit of 15%. How much money does Lauren need for the deposit?

.....

Calculating Percentage Increase

1) Sometimes, you might need to calculate a percentage increase.
2) If so, you need to find the 'percentage of' first. Then you add it on to the original number.

Example

In 2009 a town's population was 2500. By 2012, it had increased by 6%. How many people live in the town in 2012?

Answer:

1) Find 6% of 2500: $\frac{6}{100} \times 2500 = 6 \div 100 \times 2500 = 150$
2) Add this on to 2500: $2500 + 150 = 2650$

So, 2650 people live in the town in 2012.

Calculating Percentage Decrease

1) You might also need to calculate a percentage decrease.

2) First you find the 'percentage of'. Then you take it away from the original number.

Example

Last year a company made a profit of £20 000. This year, profits are down by 12%. How much profit did the company make this year?

Answer:

1) Find 12% of £20 000: $\frac{12}{100} \times 20\,000 = 12 \div 100 \times 20\,000 = £2400$

So the company made £2400 less profit.

2) Take this away from £20 000: $20\,000 - 2400 = £17\,600$

The company made **£17 600** profit.

Practice Questions

1) Penny is the manager of a retail outlet. The outlet offers a 40% discount on designer clothes. If a dress normally costs £120, how much should Penny sell it for?

.....

.....

2) Jim earns £21 000 a year. He's given a pay rise of 2%.
How much will Jim earn after his pay rise?

.....

.....

3) A company made a profit of £35 000 last year. This year, its profits have increased by 5%.
How much profit did the company make this year?

.....

4) In January, a florist took orders from 260 customers. In February, orders were up by 75%.
How many customers placed an order in February?

.....

.....

Fractions, Decimals and Percentages

These Fractions, Decimals and Percentages Are All the Same

The following fractions, decimals and percentages all mean the same thing.

They're really common, so it's a good idea to learn them.

$\frac{1}{2}$ is the same as 0.5, which is the same as 50%.

$\frac{1}{4}$ is the same as 0.25, which is the same as 25%.

$\frac{3}{4}$ is the same as 0.75, which is the same as 75%.

$\frac{1}{1}$ is the same as 1, which is the same as 100%.

You Can Change Fractions into Percentages

To change a fraction into a percentage you should:

1) Multiply the fraction by 100. 2) Add a per cent (%) sign.

Example 1

What is $\frac{2}{5}$ as a percentage?

1) Multiply the fraction by 100: $2 \div 5 \times 100 = 40$

2) Add a % sign = 40%

Example 2

9 out of 10 people surveyed are against the closure of a local swimming pool. What percentage is this?

1) 9 out of 10 as a fraction is $\frac{9}{10}$

2) Multiply the fraction by 100: $9 \div 10 \times 100 = 90$

3) Add a % sign = 90%

Proportion

Proportions Compare a Part to the Whole Thing

1) Proportions are a way of showing how much of one part there is compared to the whole thing.

Example

Look at this pattern: 

Out of 8 tiles, 2 are white and 6 are blue.

In other words, in every 4 tiles, 1 is white and 3 are blue.

The proportion of white tiles is 1 in every 4.

The proportion of blue tiles is 3 in every 4.

2) Proportions are really another way of writing fractions.

The proportion "1 in every 4" is the same as the fraction $\frac{1}{4}$.

There's more on fractions on pages 11-15.

Practice Questions

1) 60 people have entered the baking contest at a country show.
There are different categories for pies, bread, cakes and biscuits.

a) 15 people enter the biscuit category. What proportion is this of the total entrants?

.....

b) 25 people enter the cake category. What proportion is this of the total entrants?

.....

2) 27 people are waiting at a bus stop. 18 of them are school children.
What proportion of the people waiting are school children?

.....

3) Gareth and his three brothers are the only people in a group of 20 that have birthdays in June. What proportion of the group do they make up?

.....

Ratios

Ratios Compare One Part to Another Part

Ratios are a way of showing how many things of one type there are compared to another.

Example

Look at this pattern: 

There are two white tiles and six blue tiles.

In other words, for every white tile there are three blue tiles.

So the ratio of blue tiles to white tiles is 3:1.

Questions Involving Ratios

To answer a question involving ratios, you usually need to start by working out the value of one part. For example, the cost of one thing or the mass of one part.

You can then use this to answer the question.

Example 1

Orange cordial is diluted by adding 4 parts water to every 1 part of cordial (4:1). How much water should be added to 25 ml of cordial?

1) The amount of cordial used is 1 part, so 1 part = 25 ml.

2) You need 4 parts water to each part cordial so:
The amount of water needed = amount of cordial × 4
= 25 ml × 4 = 100 ml

So **100 ml** of water should be added to the cordial.

Example 2

Some jam is made from 1 part sugar to 3 parts fruit (1:3).
500 g of jam is made. How much sugar is used?

1) First work out how many parts there are in total.
To do this, add up the numbers in the ratio:

$$1 + 3 = 4 \text{ parts}$$

2) The jam contains 1 part sugar. To work out how many g are in 1 part, divide the total amount of jam by the number of parts:

$$500 \div 4 = 125 \text{ g}$$

So **125 g** of sugar is used.

Example 3

£9000 is split between 3 people in the ratio 2:3:1.
How much money does each person get?

1) First work out how many parts are in the ratio.
To do this, add up the numbers in the ratio.

$$2 + 3 + 1 = 6$$

2) To find out how much one part is worth, divide 9000 by 6: $9000 \div 6 = 1500$

3) The first person in the ratio gets two parts. To work out how much money they get, multiply the value of one part by 2:

$$1500 \times 2 = £3000$$

4) The second person in the ratio gets three parts. To work out how much money they get, multiply the value of one part by 3:

$$1500 \times 3 = £4500$$

5) The third person gets 1 part, so they get £1500.

To check your answer, make sure all the parts add up to £9000:
3000 + 4500 + 1500 = £9000.

Working Out Total Amounts

1) You can use ratios to work out total amounts.

2) You need to know the value of one part. (You may have to work this out or it might be given to you in the question.)

3) Then work out the total number of parts.

4) You can then multiply the total number of parts by the value of one part, to find the total amount.

Example

A jelly is made from one part gelatin and four parts water.
320 g of water is used. How much jelly is made in total?

1) Find the value of one part by dividing the total amount of water by the number of parts of water: $320 \div 4 = 80$ g

2) Find the total number of parts by adding up the numbers in the ratio: $1 + 4 = 5$

3) Times the total number of parts by the amount given for one part: $5 \times 80 = 400$ g

Practice Questions

) Ollie is making salad dressing. He mixes 1 part vinegar to 2 parts oil.
Ollie makes 450 ml of salad dressing. How much oil does he use?

.....

.....

) A union votes on whether to go on strike. 120 people vote. The ratio of yes:no votes is 2:3.

a) How many people vote yes?

.....

.....

b) How many people vote no?

.....

) Hamish is making icing. He mixes 1 part icing sugar to 2 parts water.
He uses 100 g of icing sugar. How much icing will he make?

.....

.....

) Dawn is mixing wallpaper paste. She mixes 1 part glue to 3 parts water.
Dawn uses 1.5 litres of water. How much wallpaper paste will she make in total?

.....

.....

George is a sheep farmer. His herd contains Herdwick sheep and Blackface sheep in the ratio 3:2. George has 180 Herdwick sheep. How many sheep does he have in total?

.....

.....

.....

Scaling Up and Down

You Can Use Proportion to Scale Up and Down

You can use proportions to scale things up and down.
You usually start by working out the values for one thing.

Example 1

Lucy is making cakes. She finds this recipe →

Recipe for 12 cakes:
150 g flour
75 g sugar
75 g margarine
3 eggs

Lucy wants to make 20 cakes.
How much margarine does she need?

1) Start by working out how much margarine is needed for 1 cake.

   This recipe is for 12 cakes, so you need to divide the weight of the margarine by 12:

   $75 \div 12 = 6.25$ g

2) To find out how much margarine Lucy needs to make 20 cakes, multiply the weight of margarine needed for 1 cake by 20:

   $6.25 \times 20 =$ **125 g**

Example 2

6 bags of crisps cost £1.80. How much will 2 bags cost?

1) First, you need to find out how much 1 bag of crisps costs.
   You know that 6 bags cost £1.80, so you need to divide £1.80 by 6.

   cost of 1 bag = $1.80 \div 6 =$ £0.30

2) To work out the cost of 2 bags, times your answer by 2.

   $0.30 \times 2 =$ **£0.60** or **60p**

Example 3

Dave is a baker. He bakes 500 biscuits in a 4 hour shift.
How many biscuits can Dave bake in a 6 hour shift?

1) Start by working out how many biscuits Dave bakes in 1 hour.

   He bakes 500 biscuits in 4 hours,
   so you need to divide 500 by 4: $500 \div 4 = 125$ biscuits

2) Multiply your answer by 6 to find out how many biscuits Dave can bake in 6 hours: $125 \times 6 =$ **750 biscuits**

Example 4

A breakfast cereal contains 0.4 g of calcium per 100 g. How much calcium does a 35 g serving of the breakfast cereal contain?

1) Start by working out how much calcium is in 1 g of the cereal.

   There is 0.4 g of calcium in 100 g of cereal, so you need to divide 0.4 by 100: $0.4 \div 100 = 0.004$ g

2) Multiply your answer by 35 to find out how much calcium is in 35 g of cereal: $0.004 \times 35 =$ **0.14 g**

Practice Questions

) Freya is making soup. She needs 500 g of carrots to make 1 litre of soup. How many grams of carrots does she need to make 1.5 litres of soup?

.....

.....

1000 ml of lemonade contains 250 ml of lemon juice. How much lemon juice does 750 ml of lemonade contain?

.....

.....

Leon runs 10 km in 49 minutes. Assuming he runs at the same speed, how long should it take him to run 18 km?

.....

.....

Sharon is making greetings cards. Each card takes her twenty minutes to make. How many can she complete in two and a half hours?

.....

.....

Formulas in Words

A Formula is a Type of Rule

1) A formula is a rule for working out an amount.

2) Formulas can be written in words. Sometimes, it can be tricky to spot the formula.

Example

Mike packs 40 boxes an hour. How many boxes can he pack in 6.5 hours?

You're told that: "Mike packs 40 boxes an hour." This is a formula. You can use it to work out how many boxes Mike can pack in a given number of hours.

1) The calculation you need to do here is:

Number of boxes = 40 × number of hours

2) You've been asked how many boxes Mike can pack in 6.5 hours, so put '6.5' into the calculation in place of 'number of hours':

Number of boxes = 40 × 6.5 = 260

You can use the same formula to work out how many boxes Mike can pack in any number of hours.

Formulas Can Have More Than One Step

Some formulas have two steps in them. You need to be able to use two-step formulas.

Example

Owen has moved into a new house. The telephone company will charge him £110 to connect his phone line, then line rental at £11.50 per month. How much will Owen's phone line have cost him after 12 months?

The formula here is "£11.50 per month, plus £110".

1) Work out the calculation you need to do:

Step 1 = 11.50 × number of months

Step 2 = + 110

Cost of phone line = (11.50 × number of months) + 110

There's more on brackets on page 6.

2) Then just stick the right numbers in.
In this case it's '12' in place of 'number of months':

(11.50 × 12) + 110 = £248

Practice Questions

Dan is getting some furniture delivered. Delivery costs £5 per item, plus £20 to assemble all the items. How much will it cost Dan to get 4 items of furniture delivered and assembled?

.....

.....

Chrissie needs a wallpaper stripper. It costs £10 a day to hire, plus a deposit of £40. How much will it cost Chrissie to hire the wallpaper stripper for 3 days (including the deposit)?

.....

.....

Angela is leaving her car parked at the airport whilst she goes away on business for 5 days. It costs £11.50 per day to park there and there is a one-off charge of £10.
How much will it cost Angela to park for 5 days?

.....

.....

Shabnam is a babysitter. She charges £5.00 an hour before midnight and £6.50 an hour after midnight. How much will Shabnam earn babysitting from 8 pm to 2 am?

.....

.....

.....

Josie takes a taxi when she travels between her house and town.
The journey from her house to town (or the other way around) usually costs £8.
If she travels after 11 pm the journey costs £12.

In one week Josie travelled to town and back four times. All the trips to town were before 11 pm. One journey back was after 11 pm. How much did she spend on taxis?

.....

.....

.....

More Formulas

Formulas Can be Shown Using Letters

You might be given a formula made up of letters. Each letter represents something.

Example

To work out speed you divide distance by time.

As words, this can be written as:

speed = distance ÷ time

The formula can be shortened by using letters instead of full words.

$$s = d \div t$$

s represents speed d represents distance t represents time

Putting Numbers into Formulas

You can substitute numbers into a formula that is written as letters.

Example 1

$s = d \div t$

s represents speed
d represents distance
t represents time

A bus travels 100 metres in 8 seconds. Work out the speed it was travelling.

1) Start by working out what letters you have values for and what they are.

You're told that the bus travels a distance of 100 m, so d = 100 m.
You're told the bus travels for 8 seconds, so t = 8 s.

2) You can substitute these numbers into the formula:

$s = d \div t$

$s = 100 \div 8$

$s = 12.5$ metres per second

The units are metres per second as you're dividing a distance in metres by a time in seconds

So the bus is travelling at **12.5 metres per second**.

Example 2

GlobalPhone mobile phone deals are worked out using the formula below.

$$\text{cost} = m(5n + 1000)$$

cost = price in pence, m = number of months,
n = number of free text messages per month.

Jack wants a 12 month deal, with 500 free texts per month.
How much will this cost?

1) Start by writing the formula out in full.
Times (×) signs are sometimes left out of formulas to simplify them.

So... $5n = 5 \times n$ and $m(5n + 1000) = m \times (5n + 1000)$

So the formula can be written as: $\text{cost} = m \times (5 \times n + 1000)$

2) Work out what values the letters have:

Jack wants a 12 month contract, so m = 12.
He wants 500 free texts, so n = 500.

3) Substitute these numbers into the formula:

$\text{cost} = 12 \times (5 \times 500 + 1000)$
$\text{cost} = 12 \times (3500)$
$\text{cost} = 42\,000$ p

So it will cost **42 000p** or **£420**.

Example 3

Temperature can be measured in degrees Celsius (°C) or degrees Fahrenheit (°F). The formula: $F = \frac{9}{5}C + 32$ can be used to swap between the two.

C represents Celsius and F represents Fahrenheit.

If the temperature is 15 °C, what is the temperature in Fahrenheit?

1) Write out the formula in full: $F = \frac{9}{5} \times C + 32$

2) Put numbers in place of any letters you know.
Here you're told that C = 15: $F = \frac{9}{5} \times 15 + 32$

3) Work it out in stages.
Write down values for each bit as you go along:
$F = 27 + 32$
$F = 59$

So the temperature is **59 °F.**

Practice Questions

1) Jim uses the formula below to work out how many fence posts he needs.

$$n = p + 1$$

Where n = number of fence posts and p = number of fence panels.

a) Jim's front garden fence will have 6 panels. How many fence posts does he need?

.....

b) Jim's back garden fence will have 13 panels.
How many fence posts does he need for the back garden?

.....

2) A teacher is organising a school trip. The formula $s = c \div 20$ is used to work out the number of staff needed on the trip. s represents the number of staff needed and c represents the number of children on the trip. If 80 children are on the trip, how many staff are needed?

.....

.....

3) The formula on the right is used to find the cost in pounds, (including a deposit), of hiring some bikes. Jill wants to hire 4 bikes for 5 hours. How much will this cost?

Cost = b(10n + 30)

b = number of bikes
n = number of hours

.....

.....

.....

You May Need to Rearrange Formulas

Sometimes you'll need to rearrange a formula.

Example

A car travelling at 30 m/s travels 300 metres.
Calculate the time this takes.

You know speed and distance, and you need to work out the time. But the formula you've got is $s = d \div t$.

So you need to rearrange it so you have t = instead of s =

$s = d \div t$

s = speed,
d = distance,
t = time.

How to Rearrange Formulas

Find the letter you need to work out the value of — it's this letter you need to get on its own.

Then rearrange the formula by adding, subtracting, multiplying or dividing letters.

But you can't just move the letters around however you'd like. There are rules to follow:

1) You use multiplications to remove divisions.
2) You use divisions to remove multiplications.
3) You use adding to remove subtractions.
4) You use subtractions to remove additions.
5) If you add, subtract, multiply or divide one side of the formula you need to do exactly the same to the other side.

Example 1

The formula below can be used to work out how many students are in a class.

$$n = m + w$$

Where n = total number of students, m = number of men, w = number of women.

There are 31 students in a class, 16 are women. How many are men?

1) You need to get m on its own, so you need to move the + w.
2) Write out the original equation. → $n = m + w$
   Subtract w from both sides. → $n - w = m + w - w$
   The + w and – w cancel each other out. → $n - w = m$
3) Put the numbers you know into the rearranged formula:

   The left and right side have just been swapped around so it's a bit easier to see m on its own. →

$$m = n - w$$
$$m = 31 - 16$$
$$m = \mathbf{15}$$

Example 2

A car drives for 15 seconds at a speed of 30 m/s.
Calculate the distance it travels in this time.

$s = d \div t$

s = speed,
d = distance,
t = time.

1) You need to get d on its own, so you need to move the ÷ t.
2) Write out the original equation. → $s = d \div t$
   Multiply both sides by t. → $t \times s = d \div t \times t$
   ÷ t and × t cancel each other out. → $t \times s = d$
3) Put the numbers you know into the rearranged formula. →

$$d = s \times t$$
$$d = 30 \times 15$$
$$d = \mathbf{450\ m}$$

Don't forget your units.

Example 3

The formula below is used to work out the cost of hiring some boats.

Cost in pounds = b(5h + d)
b = number of boats, h = number of hours, d = deposit per boat

Faheem has paid £60 to hire 3 boats for 1 hour. How much was the deposit?

1) You need to get d on its own so you need to move b and 5h to the other side.

2) Cost = b(5h + d) is the same as Cost = b × (5h + d).

3) Divide both sides by b. → Cost ÷ b = b × (5h + d) ÷ b
Cost ÷ b = (5h + d)

4) Subtract 5h from both sides. → (Cost ÷ b) – 5h = 5h + d – 5h
(Cost ÷ b) – 5h = d

5) Put in the numbers you know and find the value of d.

d = (60 ÷ 3) – (5 × 1) ← 5h is the same as 5 × h.
d = 20 – 5 = £15

6) This is the deposit per boat, so multiply it by 3.

Total deposit = 3 × 15 = **£45**

Practice Questions

1) A distance in miles (M) can be changed into kilometres (K) using the formula below:

$$M = \frac{5}{8}K$$

If a van travels 3.75 miles, how far has it travelled in kilometres?

.....

.....

2) The length of material needed to make a skirt can be worked out using the formula m = 1.5w + 5. m = length of material (in cm) and w = waist measurement (in cm). If a piec of cloth is 95 cm long what is the maximum waist measurement a skirt could have?

.....

.....

.....

Units

All Measures Have Units

1) Almost everything that you measure has units. For example, metres (m) or grams (g).

2) They're really important. For example, you can't just say that a distance is 4 — you need to know if it's 4 miles, 4 metres, 4 kilometres, etc.

Units of Length

1) Length is how long something is. Some common units for length are millimetres (mm), centimetres (cm), metres (m) and kilometres (km).

2) Here's how some of these units are related:

Length
1 cm = 10 mm
1 m = 100 cm
1 km = 1000 m

3) Sometimes you might need to change something from one unit to another.

4) To switch between mm, cm, m and km you can multiply or divide by 10, 100, or 1000.

To go from mm to cm, divide by 10.

To go from cm to m, divide by 100.

To go from m to km, divide by 1000.

To go from cm to mm, multiply by 10.

To go from m to cm, multiply by 100.

To go from km to m, multiply by 1000.

Example 1

What is 2.7 km in m?

Answer: You're going from km to m, so multiply by 1000.

$$2.7 \text{ km} \times 1000 = 2700 \text{ m}$$

Example 2

What is 1570 mm in m?

Answer: First change from mm to cm, by dividing by 10.

$$1570 \div 10 = 157 \text{ cm}$$

Then change from cm to m, by dividing by 100.

$$157 \div 100 = 1.57 \text{ m}$$

Units of Weight

1) Weight is how heavy something is. Grams (g) and kilograms (kg) are common units for weight.

2) Here's how to change between g and kg...

Weight
1 kg = 1000 g

To go from g to kg, divide by 1000.

To go from kg to g, multiply by 1000.

Example

How many grams are there in 0.7 kg?

Answer: You're going from kg to g so multiply by 1000.

0.7 kg × 1000 = 700 g

Units of Capacity

1) Capacity is how much something will hold. Common units are millilitres (ml), centilitres (cl) and litres (L) .

2) To change between ml, cl and L you can multiply or divide by 10 or 100.

Capacity
1 cl = 10 ml
1 L = 100 cl

To go from ml to cl, divide by 10.

To go from cl to L, divide by 100.

To go from cl to ml, multiply by 10.

To go from L to cl, multiply by 100.

Example

How many millilitres are in 0.34 L?

Answer: First change from L to cl, by multiplying by 100.

0.34 L × 100 = 34 cl

Then change from cl to ml, by multiplying by 10.

34 × 10 = 340 ml

Converting Between Other Units

1) Sometimes you can't change from one unit to another by multiplying or dividing by 10, 100 or 1000.

2) You may have to multiply or divide by a different number — the number you need will be in the question. You need to follow two rules:

- Write out the information in the question, with an equals sign (=) in the middle.
- Whatever you do to the number on the left-hand side of the '=', you need to do the same to the number on the right-hand side. (And vice versa.)

Example

1 kg is equal to 2.2 lbs (pounds). How many lbs are in 4 kg?

1) Write out the information that you know: 1 kg = 2.2 lbs

2) To go from 1 kg to 4 kg you need to multiply by 4. So to find out how many lbs are in 4 kg you also need to multiply the number of pounds by 4:

$1\text{ kg} = 2.2\text{ lbs} \xrightarrow[\text{sides by 4}]{\text{Multiply both}} 1\text{ kg} \times 4 = 2.2\text{ lbs} \times 4 \xrightarrow[\text{the answer}]{\text{Work out}} 4\text{ kg} = \mathbf{8.8\text{ lbs}}$

3) Sometimes you may need to do the calculation in two bits. You may have to divide first, to find out the value of one unit, and then multiply to find the value of the number of units you're asked for.

Example

1 oz (ounce) is equal to 28 g. How many oz are in 42 g?

1) Write out the information that you know: 28 g = 1 oz

2) First, find out how many oz are in 1 g by dividing both sides by the number of g in 1 oz — which is 28.

$28\text{ g} = 1\text{ oz} \xrightarrow[\text{sides by 28}]{\text{Divide both}} \frac{28}{28}\text{g} = \frac{1}{28}\text{oz} \xrightarrow[\text{number of oz in 1 g}]{\text{This gives you the}} 1\text{g} = \frac{1}{28}\text{oz}$

3) Then work out how many oz are in 42 g by multiplying both sides by 42.

$1\text{g} = \frac{1}{28}\text{oz} \xrightarrow[\text{sides by 42}]{\text{Multiply both}} 1\text{g} \times 42 = \frac{1}{28}\text{oz} \times 42 \xrightarrow[\text{the answer}]{\text{Work out}} 42\text{ g} = \mathbf{1.5\text{ oz}}$

Just remember, whatever you do to the number on the left-hand side, you need to do the same to the number on the right-hand side.

Practice Questions

1) How many m are in 7.5 km?

.....

2) What is 6400 g in kg?

.....

3) What is 560 millilitres in litres?

.....

4) 1 kg is equal to 2.2 lbs. How many lbs are in 15 kg?

.....

5) 1 km = 0.62 miles. Sally has cycled 10 km. How far has she cycled in miles?

.....

6) 1 British pound (£) is the same value as 1.5 Australian dollars ($).
Deepika paid $450 for a flight. How much is this in pounds?

.....

.....

7) 1 litre = 35 fluid ounces (fl. oz). Joe needs 7 fl. oz of milk for a recipe.

a) How many litres of milk does Joe need?

.....

.....

b) How many millilitres of milk does Joe need?

.....

8) 1 foot = 12 inches. 1 inch = 2.54 cm.
Chris is 6 feet and 3 inches tall. How tall is he in cm?

.....

.....

.....

Length and Perimeter

inding the Perimeter of a Shape

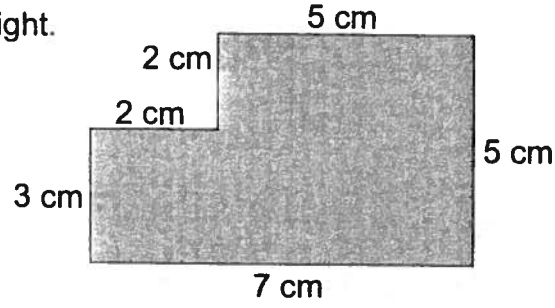
) The perimeter is the distance around the outside of a shape.

) To find a perimeter, you add up the lengths of all the sides.

Example

Find the perimeter of the shape on the right.

Just add up the lengths of all the sides — be careful not to miss any.



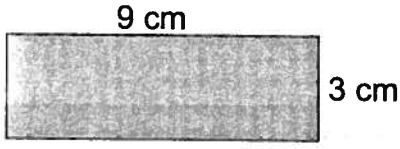
Perimeter = 7 cm + 3 cm + 2 cm + 2 cm + 5 cm + 5 cm
= 24 cm

/orking Out the Lengths of Sides of Rectangles

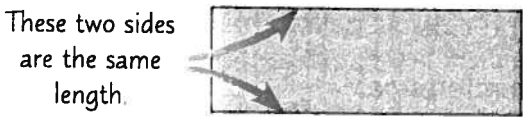
you're only given the lengths of some of the sides, you'll have to work out the rest efore you can calculate the perimeter. Sometimes this is fairly simple.

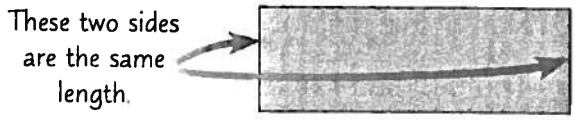
Example

This rectangle has 4 sides, but you're only given the lengths of 2 of them.



For rectangles, sides that are opposite each other are the same length.

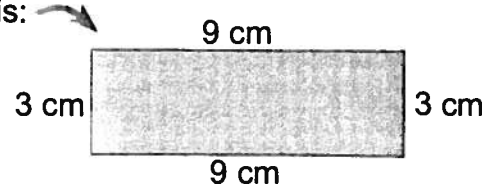




So you can label the rectangle like this:

Then just add all the sides together to find the perimeter:

9 + 3 + 9 + 3 = 24 cm

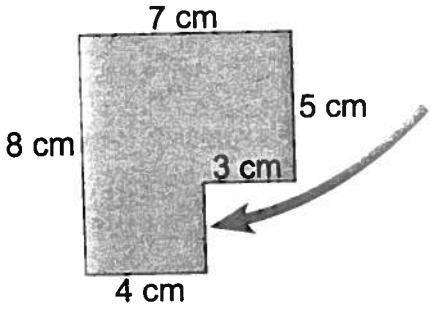


Working Out the Length of Unknown Sides of Other Shapes

It's a bit harder to find the lengths of unknown sides if you're not dealing with rectangles.

Example

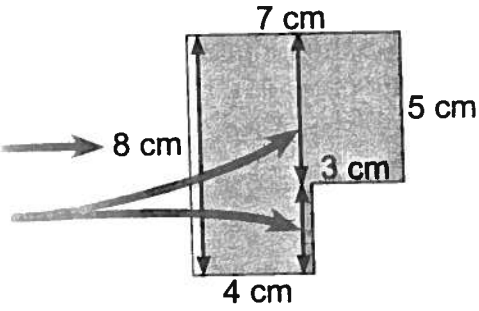
What is the perimeter of the shape below?



You need to work out the length of this side before you can find the perimeter of the shape.

The full length of the shape is 8 cm.

So, these two distances must equal 8 cm when they're added together.



The top distance is 5 cm, so to work out the length you don't know, take away 5 cm from 8 cm:

$$8 \text{ cm} - 5 \text{ cm} = 3 \text{ cm}$$

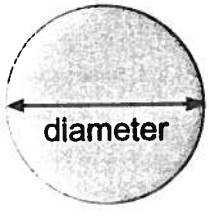
The unknown side must be 3 cm long.

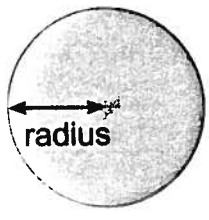
Now you can just work out the perimeter as usual...

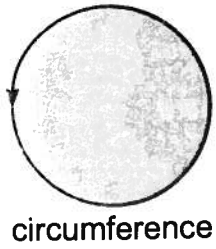
Perimeter = 8 cm + 7 cm + 5 cm + 3 cm + 3 cm + 4 cm = 30 cm

Lengths in Circles Have Special Names

1) The distance from one side of a circle to the other, going straight through the middle, is called the diameter.
2) Half of this distance (from the middle to one side) is called the radius.
3) The perimeter of a circle is called the circumference.







ctice Questions

/ork out the perimeters of the shapes below.

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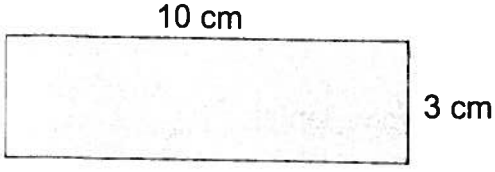

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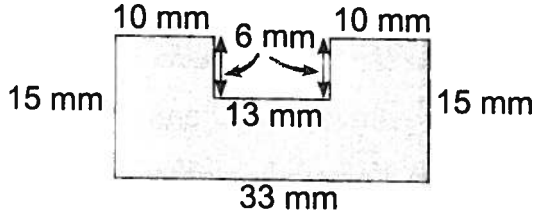

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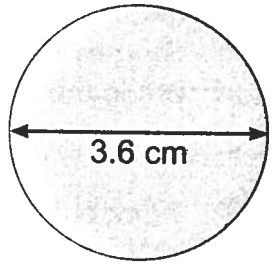
ook at the circle on the right.

) What is the diameter of the circle?



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) What is the radius of the circle?

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What name is given to the perimeter of a circle?

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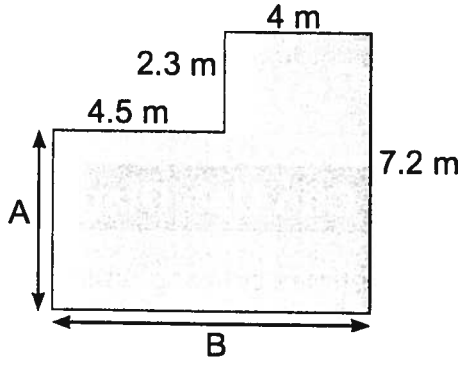
ook at the shape on the right.

What is the length of the side labelled A?



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What is the length of the side labelled B?

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What is the perimeter of the shape?

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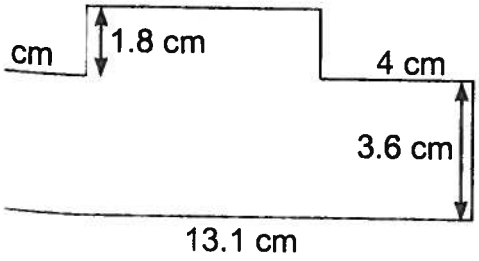
hat is the perimeter of the shape below?



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Working with Lengths

Questions Involving Length

1) There are lots of different types of questions that involve length.

2) There's no single right way to answer them, just use the information that you're given and work through it in a sensible way.

Example

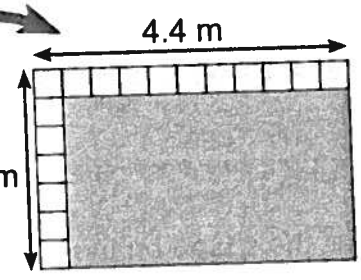
Ruaridh is tiling his kitchen floor. The floor is 2.8 m wide and 4.4 m long. The tiles are 40 cm long and 40 cm wide. How many tiles will Ruaridh need?

1) Start by changing the sizes of the tiles from cm to m, so that all the lengths are in the same units:

$40 \text{ cm} \div 100 = 0.4 \text{ m}$ Each tile is 0.4 m by 0.4 m.

2) Work out how many tiles he needs to make one row across the kitchen:

$4.4 \text{ m} \div 0.4 \text{ m} = 11$ tiles



3) Work out how many rows are needed:

$2.8 \text{ m} \div 0.4 \text{ m} = 7$ rows

4) Calculate the total number of tiles. He'll need 7 rows of 11 tiles:

$7 \times 11 =$ **77 tiles**

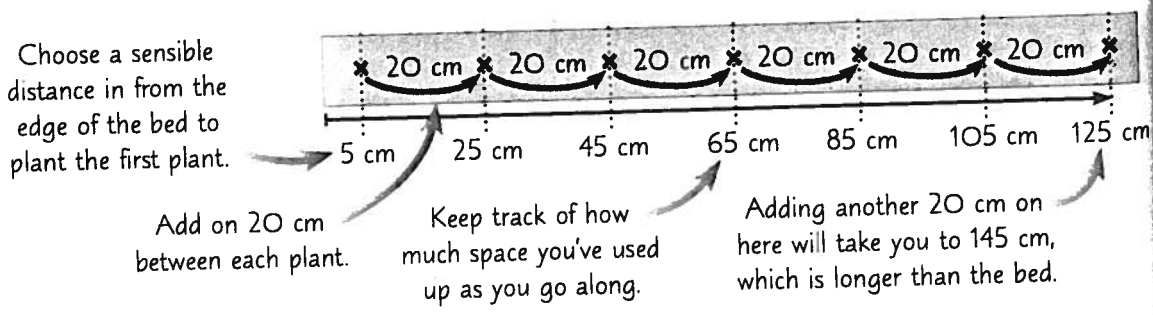
You Can Use Diagrams to Help Answer Questions

Sometimes drawing a diagram can help you to answer a question involving length.

Example

A flower bed is 1.3 m long. Anne has some plants that need to be planted 20 cm apart. How many plants can she fit in one row?

Convert the length of the flower bed to cm, so all lengths are in the same units — 1.3 m × 100 = 130 cm. The flower bed is 130 cm long.



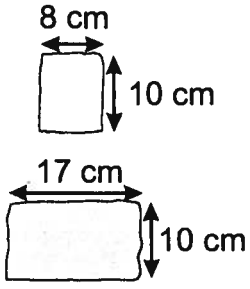
So Anne can fit **7 plants** in one row in the flower bed.

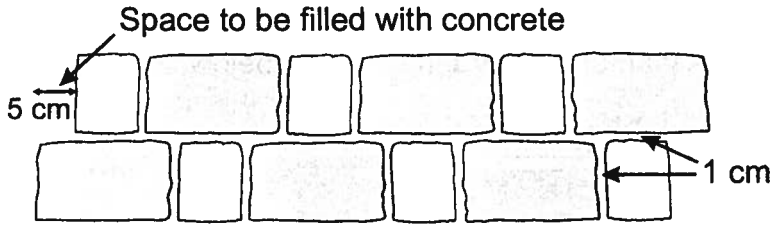
stions Involving Different Shapes and Lengths

ɜtimes you'll have to deal with different shapes and lengths in one question.

Example

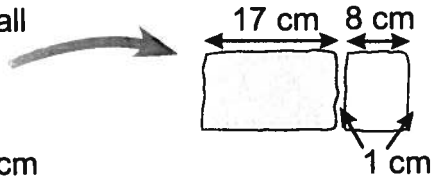
Alan wants to build a feature wall at the end of his patio. The two types of bricks he has and the pattern he wants to arrange them in are shown below. He needs to leave a 1 cm gap between each of the bricks. Gaps at the ends that aren't big enough for whole bricks will be filled with concrete.





The wall needs to be 325 cm across and will be two rows high.
How many of each type of brick will he need?

1) Group the lengths together into a section of wall that will repeat over and over. For example...



1 large brick, a gap, 1 small brick and another gap has a total length of: 17 + 1 + 8 + 1 = 27 cm

2) The wall needs to be 325 cm.

325 ÷ 27 = 12.037... So the section of wall will repeat 12 times in one row.

Work out the exact length of the wall if this section is repeated 12 times:

12 × 27 = 324 cm So there will be a 1 cm space at the end.
No brick will fit there, so it will be filled with concrete.

3) The second row of the wall starts 5 cm further in than the first row.
So the amount of space left to fill with bricks is: 325 – 5 = 320 cm

320 ÷ 27 = 11.85... So the section of wall will repeat 11 times.

The exact length of the wall if this section is repeated 11 times is:

11 × 27 = 297 cm So there will be 320 – 297 = 23 cm left over.
One more large brick could fit in this space.

4) Work out the total number of bricks.

1st row: 12 large bricks and 12 small bricks.

2nd row: 12 large bricks and 11 small bricks.

Total: 24 large bricks, 23 small bricks.

Practice Questions

1) Asif is wallpapering a wall in his dining room. The wall is 3.4 m wide. The wallpaper strips are 40 cm wide. How many strips will Asif need to buy to cover the width of the wall?

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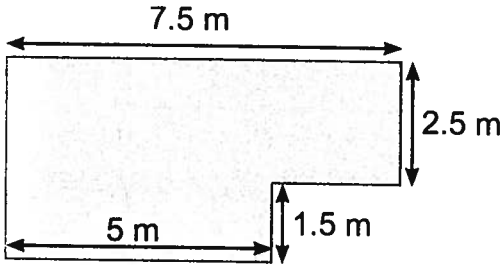
2) Jane is laying turf in the garden. The turf comes in squares that are 50 cm wide and 50 cm long. A plan of her garden is shown below. How many squares of turf will she need?



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3) Sarah is setting up an exam hall with rows of desks facing the front of the hall. The hall is 12 m wide and 15 m long. Each desk is 70 cm wide and 50 cm long. She needs to leave a 1 m gap between each desk. Starting in a corner, how many desks can she fit into the hall?

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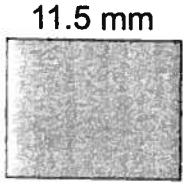
Areas of Squares and Rectangles

You Can Find the Area of Shapes by Multiplying

1) Area is how much surface a shape covers.

2) You can work out the area of squares and rectangles by multiplying the lengths of the sides together.

Example 1



Area = 11.5 mm × 9 mm

Area = 103.5 mm²

The units for the area are millimetres squared (mm²) because you've multiplied two lots of mm together.

Example 2

Lily's lawn is 12.6 m long and 8.55 m wide. What is the area of the lawn?

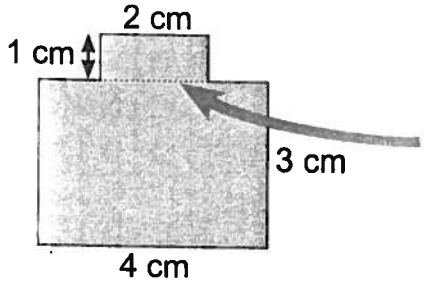
Answer: $12.6 \times 8.55 = 107.73$ m²

Sometimes You Need to Split Shapes Up to Find the Area

It's a bit trickier to find the area of a shape that isn't a rectangle...

...but you can sometimes do it by splitting the shape up into rectangles.

Example



First split the shape into two rectangles.

You can then calculate the area of each rectangle and add them together to find the total area of the shape.

Area of top rectangle: $2 \times 1 = 2$ cm²

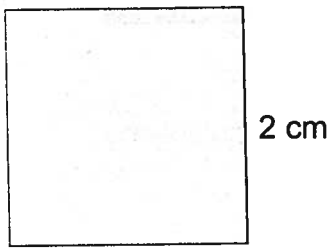
Area of bottom rectangle: $3 \times 4 = 12$ cm²

Total area: $2 \text{ cm}^2 + 12 \text{ cm}^2 = 14 \text{ cm}^2$

Practice Questions

1) Work out the area of the shapes below.

a)



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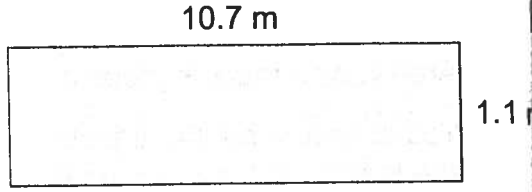
b)



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2) A rectangle is 37.5 cm long and 14.0 cm wide. What is the area of the rectangle?

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3) Each side of a square is 0.9 m long. What is the area of the square?

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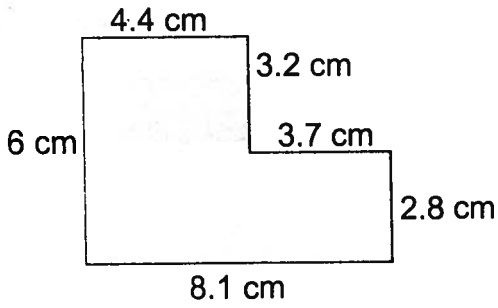
4) Find the area of the shapes below.

a)



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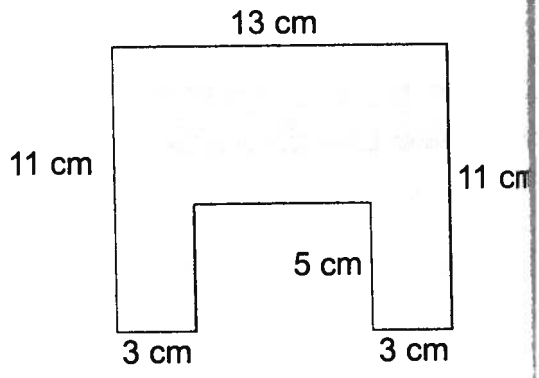

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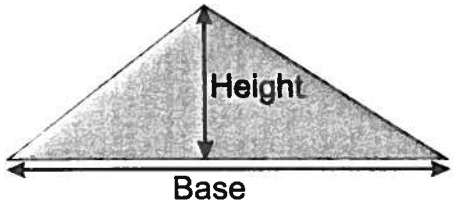
Areas of Triangles and Circles

You Can Work Out The Area of a Triangle by Multiplying

1) To work out the area of a triangle you need to multiply the length of its base by its height, and then divide by two.

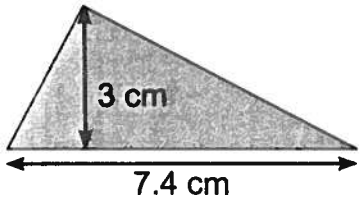


2) This can be written as a formula:

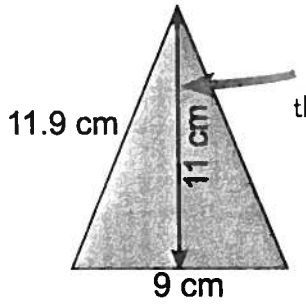
Area of triangle = base × height ÷ 2

Examples

Area of triangle = base × height ÷ 2
= 7.4 cm × 3 cm ÷ 2
= 11.1 cm²



Area of triangle = base × height ÷ 2
= 9 cm × 11 cm ÷ 2
= 49.5 cm²



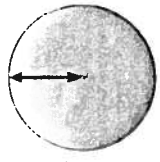
This is the height of the triangle — not the side labelled 11.9 cm.

To Calculate the Area of a Circle You Need to Use Pi (π)

There's also a formula for working out the area of a circle.

Area of circle = π × radius²

The little '2' means the radius is squared. This means you multiply it by itself. So $r^2 = r \times r$.



radius of a circle

The symbol π (called "pi") is just a very long number (3.14159...).

If you have a π button on your calculator you can use it in calculations.

If you don't have a π button, just type in 3.14 instead of π.

Pi is actually said like "pie".

urface Area is the Total Area of the Sides of a Shape

) Sometimes you might need to work out the surface area of a shape.

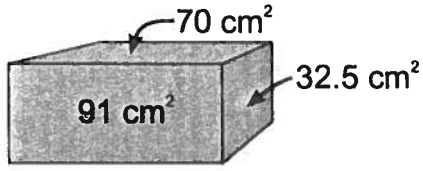
) This is just the areas of all the sides of the shape added together.

Example

The box below has two sides with an area of 91 cm², two sides with an area of 70 cm², and two sides with an area of 32.5 cm².

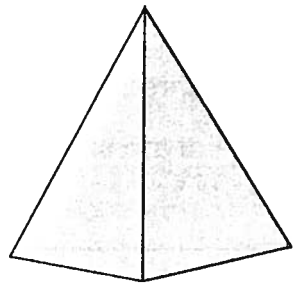
So the surface area of the shape is:

$91 + 91 + 70 + 70 + 32.5 + 32.5 = 387$ cm²



actice Questions

The base of the pyramid on the right has an area of 25 cm².
The four other sides have an area of 15 cm² each.
What is the surface area of the pyramid?



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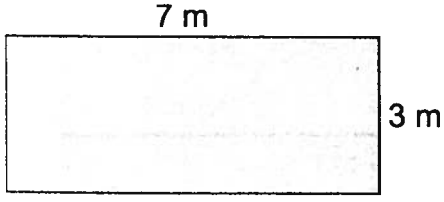
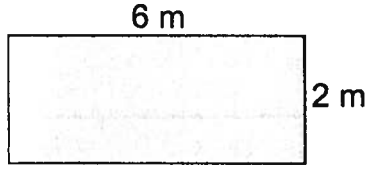
Carlos is laying concrete to make the floors of two rooms. The dimensions of the rooms are shown below. He needs to use 0.1 m³ of concrete to make 1 m² of floor. The concrete will cost £65 per m³. How much will it cost to buy enough concrete for the floors?





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Example 2

Francine runs a slimming group.
The hall where the group meets is 8.6 m long and 7.2 m wide.
Health and Safety rules state for each person in the hall there must be 1.5 m^2 of floor space. How many people (including Fran) can go to the group?

1) Work out the area of the hall.

$$8.6 \times 7.2 = 61.92 \text{ m}^2$$

2) Divide the area of the hall by 1.5 m^2 to find out how many people are allowed in the hall at a time.

$$61.92 \div 1.5 = 41.28$$

So **41 people** can go to the group.

You Can Use Area Instead of Using Length

Some problems can be answered in lots of different ways. For example, you can work out the answer to some problems using length OR using area.

Example

Ruaridh is tiling his kitchen floor. The floor is 2.8 m wide and 4.4 m long.
The tiles are 40 cm long and 40 cm wide. How many tiles will Ruaridh need?

1) Start by changing the dimensions of the tiles from cm to m, so that all the lengths are in the same units:

$40 \text{ cm} \div 100 = 0.4 \text{ m}$ Each tile is 0.4 m by 0.4 m.

2) You need to work out how many tiles will fit into the area of the floor. So calculate the area of the floor: $2.8 \times 4.4 = 12.32 \text{ m}^2$

3) Then calculate the area of one tile: $0.4 \times 0.4 = 0.16 \text{ m}^2$

4) Now divide the area of the floor by the area of one tile:

$12.32 \div 0.16 =$ **77 tiles**

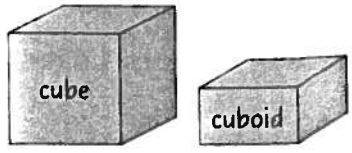
You could also answer this question using length — see page 46.

Volume

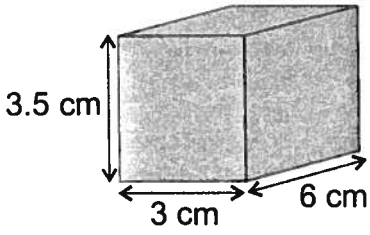
You Can Calculate the Volume of a Shape by Multiplying

1) Volume is how much space something takes up.

2) You can work out the volume of cubes and cuboids by multiplying the length, the width and the height together.



Example



Length = 6 cm Width = 3 cm Height = 3.5 cm

Volume = length × width × height

= 6 cm × 3 cm × 3.5 cm

= 63 cm^3

The units are cm^3 in this example, because you've multiplied three lots of cm together.

If the sides were measured in m, the units for volume would be m^3.

Using Volumes in Calculations

You may have to work out volume as part of a bigger calculation.

Example

Iain's fish tank is 0.9 m long, 0.3 m wide and 0.4 m high.
He is filling it with water using a container that has a volume of 3000 cm^3.

How many times will he need to empty the container into the tank to fill the tank?

1) Convert the sizes of Iain's fish tank into cm so that all measurements are in the same units: 0.9 m = 90 cm, 0.3 m = 30 cm and 0.4 m = 40 cm.

2) Calculate the volume of the tank. → 90 × 30 × 40 = 108 000 cm^3

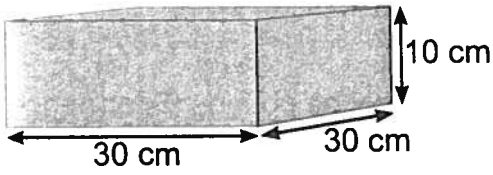
3) Calculate how many times the volume of the container will go into the volume of the tank. → 108 000 ÷ 3000 = 36

So Iain will need to empty the container **36 times** to fill the tank.

Practice Questions

1) Calculate the volume of the shapes below.

a)



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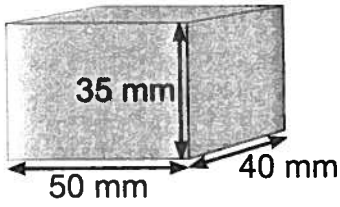

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2) Sarah has a suitcase that is 1.2 m long, 0.7 m wide and 20 cm deep.
What is the volume of the suitcase?

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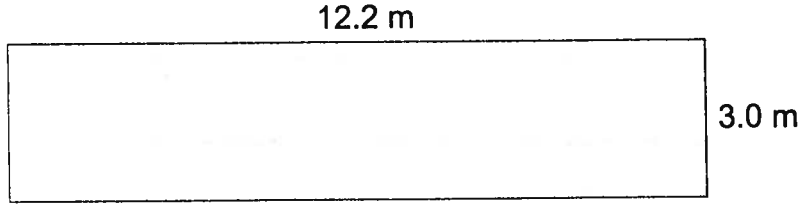
3) George is buying gravel to put on his driveway. The driveway is shown below.
He needs the gravel to be 2 cm deep. He can buy gravel in bags that weigh
1 tonne, and cover 1 000 000 cm^3. How many bags will he need to buy?



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Money

Pounds and Pence

1) If you get a question on money, the units will probably be pounds (£) or pence (p).
2) You need to be able to switch between using pounds and using pence.

To go from pounds to pence, multiply by 100.

To go from pence to pounds, divide by 100.

Examples

What is £11.25 in pence?

Answer: You're going from pounds to pence, so multiply by 100.

£11.25 × 100 = 1125p

What is 37p in pounds?

Answer: You're going from pence to pounds, so divide by 100.

37p ÷ 100 = £0.37

Use Pounds OR Pence in Calculations — Not Both

1) You may get a question that uses pounds and pence.
2) If you do, you'll need to change the units so that they're all in pounds or all in pence.

Example

Callum buys fish and chips for £5.25, a carton of gravy for 60p and a cup of tea for 75p. How much does he need to pay in total?

1) Change the carton of gravy and cup of tea from pence to pounds.

60p ÷ 100 = £0.60

75p ÷ 100 = £0.75

2) All the prices are in the same units now (£), so just add them up.

£5.25 + £0.60 + £0.75 = £6.60

3) If the question tells you what units to give your answer in then make sure you use those. If it doesn't, you can change everything into pounds or into pence.

Calculate the Price Per Item to Work Out Value For Money

1) If you're buying a pack of something, you can work out how much you're paying for each item.

Price per item = total price ÷ number of items

2) You can then compare the price per item for that pack with other packs.

Example

A shop sells crisps in multipacks of 6 or 12.
The 6-pack costs £1.68. The 12-pack costs £3.00.

6-pack: Price per bag = £1.68 ÷ 6 = £0.28 ← Price per bag = total price ÷ number of bags

12-pack: Price per bag = £3.00 ÷ 12 = £0.25 ←

The 12-pack costs less per bag, so it's better value than the 6-pack.

You Can Also Calculate the Price Per Gram

You can also compare costs by looking at how much you'd pay per unit weight of something. For example, how much you'd pay per gram, or per kilogram.

Price per gram = total price ÷ number of grams

Example

An 800 g bag of muesli costs £2.00. A 500 g bag of muesli costs £1.50.

800 g bag: Price per gram = £2.00 ÷ 800 = £0.0025

500 g bag: Price per gram = £1.50 ÷ 500 = £0.003

The prices per gram are very small numbers. It's easier to compare them when the units are pence, so convert the price per gram from pounds to pence.

800 g bag: Price per gram = 200p ÷ 800 = 0.25p

500 g bag: Price per gram = 150p ÷ 500 = 0.30p

The 800 g bag costs less per gram, so it's better value than the 500 g bag.

If you needed to work out the price per kilogram or the price per ounce, for example, you'd do it in exactly the same way — just swap grams for the units you're using.

Practice Questions

1) a) What is £16.42 in pence?

.....

b) What is 210p in pounds?

.....

2) A pet shop sells a 6-can multipack of dog food for £3.18 and a 12-can multipack for £6.24. Which multipack is the best value for money?

.....

.....

3) Michelle buys a 14 g jar of herbs for £0.95. Her friend Zoe buys a 7 g jar for £0.60. Who has got the best value?

.....

.....

Work Out the Value of Offers to Find the Best Deal

To find the best deal you need to work out how much you'd pay with each offer, or which offer takes the most off the total price.

Example

Malcolm wants to hire a van for two days from Hire-a-van or Speedy Hire.

Hire-a-van — £65 per day with 15% off the total price for bookings of more than one day.

Speedy Hire — £63 per day.

Malcolm has a £10 off voucher he could use with Speedy Hire.

Which company should Malcolm use to get the best deal?

Hire-a-van → Cost of two days' hire = £65 × 2 = £130
Discount for booking two days = 15 ÷ 100 × £130 = £19.50
Total cost = £130 – £19.50 = £110.50

Speedy Hire → Cost of two days' hire = £63 × 2 = £126
Voucher discount = £10
Total cost = £126 – £10 = £116

So Malcolm will get the best deal by hiring a van from Hire-a-van.

Profit is the Amount of Money Made

Profit is the difference between the cost of making something and the price it's sold for.

Profit = selling price – cost of making it

Example

Geoff makes wooden benches. Each bench costs him £34 to make and he sells them for £75. How much profit does Geoff make on each bench?

Profit = £75 – £34 = £41

Geoff makes £41 on each bench he sells.

If something costs more to make than it sells for, the profit will be a negative number — this is called a loss.

Percentage Profit Compares Money Made to Money Spent

You could be asked to work out the percentage profit made on an item. To work this out you need to calculate the profit and then work out what this is as a percentage of the cost of making it.

Example 1

Chloe makes and sells stuffed animal toys. The cost of making her last toy was £40. The toy sold on an auction website for £52.
How much profit did she make?

1) Work out the profit. → Profit = selling price – cost of making
= £52 – £40 = £12

2) Work out the percentage profit. → % profit = $\frac{12}{40} \times 100 = 30\%$

So Chloe made a 30% profit on the toy.

Example 2

For her next toy, Chloe want to make a 40% profit.
The cost of making the toy is £25.
What price does the toy need to sell for to make 40% profit?

1) Work out 40% of the costs. → $\frac{40}{100} \times £25 = £10$

2) Add this 40% to the costs. → £25 + £10 = £35

So Chloe needs to charge £35 to make 40% profit on this toy.

Practice Questions

1) Gillian is buying a new carpet that she would like fitting in her lounge.
The carpet showroom offers Gillian free fitting or 20% off her total bill.

The cost of the carpet is £396.50
The cost of fitting is £120.00

Which offer will save Gillian the most money?

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2) Josh buys 2 bottles of lemonade that are on a buy one get one half price offer.
They normally cost £0.90 each. How much does Josh save with the offer?

.....

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3) Dafydd sells DVDs on a market stall.
He buys the DVDs for £2.60 and sells them on for £3.90.

a) How much profit does he make on each DVD?

.....

b) What is Dafydd's percentage profit on each DVD?

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4) Luke makes fruit cakes for a stall at a village fete. It costs Luke £1.80 for the ingredients for each cake. If he wants to make 35% profit on each cake, how much money should Luke be charging for each cake?

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Time

The 12-Hour Clock and the 24-Hour Clock

1) You can give the time using the 12-hour clock or the 24-hour clock.

2) The 24-hour clock goes from 00:00 (midnight) to 23:59 (one minute before the next midnight).

Example

03:00 is 3 o'clock in the morning. 15:00 is 3 o'clock in the afternoon.

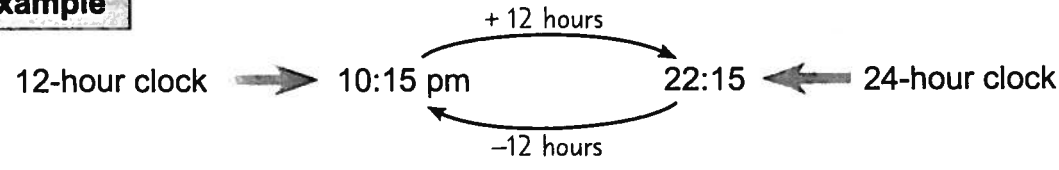
3) The 12-hour clock goes from 12:00 am (midnight) to 11:59 am (one minute before noon), and then from 12:00 pm (noon) till 11:59 pm (one minute before midnight).

Example

6 am is 6 o'clock in the morning. 6 pm is 6 o'clock in the evening.

4) For times in the afternoon, you need to add 12 hours to go from the 12-hour clock to the 24-hour clock. Take away 12 hours to go from the 24-hour clock to the 12-hour clock.

Example

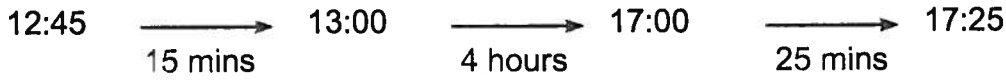


Working Out Lengths of Times

To work out how long something took, break it into stages.

Example

Ben set off on a walk at 12:45 and got back at 17:25.
How long was his walk?



Add up the hours and minutes separately: 4 hours
15 mins + 25 mins = 40 mins

So the walk took 4 hours and 40 mins.

Working Out Times

1) You may need to work out what time something will happen. For example, what time something will start or finish, when to meet someone or when something needs to start.

2) The best way to do this is to split the time into chunks.

Example 1

Ruth is going to watch a film at the cinema. The film lasts 2 hours and 30 minutes. There's a 15 minute interval in the middle of the film. If the film starts at 19:30, what time should the film end?

The film should finish at 22:45.

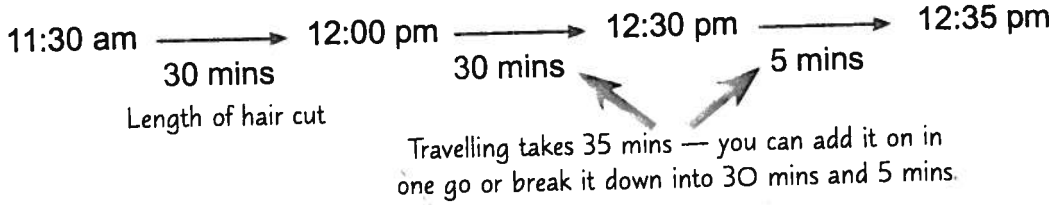
Example 2

Danny needs to pick his dog up from the vets.

He is getting his hair cut at 11:30 am which should take half an hour.

It will then take him about 35 minutes to travel to the vets.

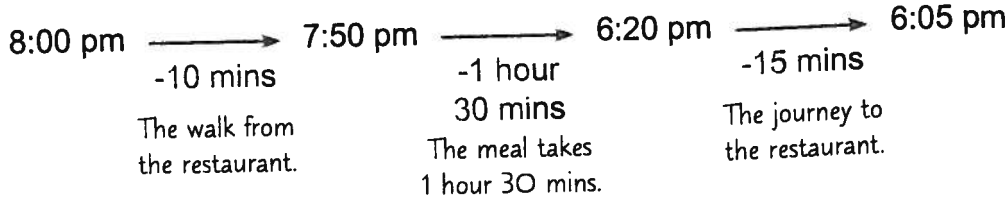
What is the earliest time Danny should arrange to pick up his dog?



So the earliest he can be at the vets is 12:35 pm.
To be on the safe side he might arrange to be there at 12:45 pm.

Example 3

Jeremy and his friends are going out for the evening. They are going to a restaurant (a 15 minute journey), having a meal (taking about an hour and a half), before going to a play that starts at 8 pm (10 minutes' walk from the restaurant). What time do they need to set off?



Working back from 8 pm this means they should set off by 6:05 pm.

Practice Questions

1) Change the times below from the 24-hour clock to the 12-hour clock.

a) 08:30 .....

b) 19:57 .....

2) Change the times below from the 12-hour clock to the 24-hour clock.

a) 6:15 pm .....

b) 12:03 am .....

3) Mischa has a bus to catch at 11:10 pm. The time is 22:59. Has she missed it?

.....

4) A play starts at 8:30 pm and finishes at 11:00 pm. How long is the play?

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5) Mike gets on a train at 10:55 am and gets off at 12:44 pm. How long was his train journey?

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6) Cassandra arrives at the library at 4:28 pm. The library closes at 5:00 pm.
How long does Cassandra have before the library closes?

.....

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7) Katie is doing her laundry. The washing machine cycle will take 70 minutes.
If she put the washer on at 6:52 pm, what time will her washing be ready?

.....

.....

Practice Questions

8) Charlotte wants to watch three half an hour episodes of a TV programme. She'll stop for 40 minutes to have dinner. If she starts watching at 16:45, what time will she finish?

.....

.....

.....

9) Phillip plans to meet up with friends at 20:00.

He usually gets home from work at 6:00 pm.

Before he meets his friends he wants to go to the supermarket to do some shopping. He reckons he will need three quarters of an hour in the supermarket and it takes him 20 minutes to drive to the supermarket from his house.

When he gets back home it will take him 20 minutes to get to the meeting place.

Will he be able to meet his friends at 20:00?

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10) Corinne is meeting her daughter for lunch in town at 1:15 pm. Before she meets her she needs to visit the florist and the bank. She thinks she'll be at the florists for about 25 minutes and at the bank for about 10. She wants to leave 20 mins for getting between the florist and the bank, and it will take her half an hour to walk to town.

What time should she leave home for town?

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Timetables

Timetables Have Information About When Things Happen

1) Timetables have columns and rows.
2) Columns are the strips that go up and down. Rows are the strips that go across.
3) There are lots of different types of timetables — the best way to learn how to use them is to practise.

Example 1

The timetable below shows bus times.
What time would you need to leave Barrow to get to Ulverston for 15:30?

Barrow	14:10	14:30	14:50	15:10
Hospital	14:24	14:44	15:04	15:24
Dalton	14:36	14:54	15:16	15:36
Lindal	14:39	14:57	15:19	15:39
Swarthmoor	14:42	15:00	15:22	15:42
Ulverston	14:47	15:05	15:27	15:47

1) Find Ulverston in the timetable.
2) Follow that row until you reach the last time before 15:30. It's 15:27.
3) Go up the column till you reach the top row — the leaving time from Barrow.
4) So you'd need to leave Barrow at 14:50.

Example 2

Brendan works in a records office. His timetable for one week is below.

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00-12:00	Archives	Help desk	Cataloguing	Help desk	Cataloguing
12:00-13:00	Lunch	Help desk	Lunch	Archives	Lunch
13:00-14:00	Help desk	Lunch	Archives	Lunch	Help desk
14:00-17:00	Cataloguing	Archives	Cataloguing	Cataloguing	Archives

1) What time is lunch on Wednesday? Answer: 12:00-13:00
2) Where will Brendan be at 1:30 pm on Monday? Answer: Help desk.
3) When will Brendan be in the archives on Tuesday? Answer: 14:00-17:00.

You Need to be Able to Create Timetables

There are no set rules for making timetables. You just need to use the information that you're given and fit it together the best way you can.

Example

Jack is a mechanic. He has four cars to work on today.
He has estimated how long he'll need to spend on each car:

Mr Wills' car: 2½ hours Mrs Fell's car: 1 hour

Mr Nuttall's car: 1½ hours Mr Goodwin's car: 1½ hours

Jack starts work at 08:00 and finishes at 16:00.

Work on Mr Wills' car and Mr Nuttall's car needs to be done before 14:00.
Work on Mrs Fell's car must be done first.

Jack gets an hour for lunch and a 10 minute break after every 2 hours of work.
Draw a timetable for his day.

Answer:

There are several different timetables that would work for this question.
Just make sure you follow all of the instructions from the question.

Here's an example of a timetable that would work:

The first job can start at 8:00.

Job	Time working		Duration (minutes)
	From	To	
Mrs Fell's car	08:00	09:00	60
Mr Wills' car	09:00	10:00	60
Break	10:00	10:10	10
Mr Wills' car	10:10	11:40	90
Mr Nuttall's car	11:40	12:10	30
Break	12:10	12:20	10
Mr Nuttall's car	12:20	13:20	60
Lunch	13:20	14:20	60
Mr Goodwin's car	14:20	15:50	90

Make sure the correct amount of time is spent working on each car.

Make sure you put lunch at a sensible time.

The last job needs to have finished by 16:00 at the latest.

Practice Questions

1) Look at the train timetable on the right.

York	14:13	15:08	16:00
Leeds	14:49	15:49	16:35
Hebden Bridge	15:37	16:38	17:10
Blackburn	16:14	17:14	17:38
Preston	16:32	17:32	18:03

a) What's the latest train you can catch from York to get to Blackburn before 17:30?

.....

b) What time would you need to catch the train from Leeds to get to Preston before 6 pm?

.....

2) Hazel is a mobile cleaner. Her bookings for the week are shown below. Hazel has been asked whether she can fit a two-hour slot for a new customer (Mrs Johnson) into her timetable. Suggest a time that Hazel could clean for Mrs Johnson.

<table>
<tr><th></th><th>Mon</th><th>Tue</th><th>Wed</th><th>Thur</th><th>Fri</th></tr>
<tr><td>9:00</td><td rowspan="3">Mrs Simons</td><td></td><td rowspan="7">Day off</td><td></td><td rowspan="2">Mr Stevens</td></tr>
<tr><td>10:00</td><td rowspan="2">Mr Scarisbrick</td><td></td></tr>
<tr><td>11:00</td><td>Mr Price</td><td></td></tr>
<tr><td>12:00</td><td>Lunch</td><td>Lunch</td><td>Lunch</td><td></td></tr>
<tr><td>13:00</td><td rowspan="2">Mrs Baldwin</td><td>Lunch</td><td rowspan="2">Dr Green</td><td>Lunch</td></tr>
<tr><td>14:00</td><td></td><td rowspan="2">Mr Sepp</td></tr>
<tr><td>15:00</td><td></td><td></td><td></td></tr>
</table>

.....

3) A theatre is hosting a dance show that runs over two nights. The acts are shown in the table below. Each night the show starts at 7:30 pm and has two halves which are 90 minutes long. There is a 15 minute interval between them.

In both shows, each half must contain three different styles of act.
Each act's performance is 30 minutes long and can only be performed once a night.

Plan a timetable for the shows.

Act	Style
Streetdance*	Urban
Camberwell	Urban
Super Eights	Swing
DUBDS	Belly
Xtreme Beats*	Urban
Salsa Stream	Salsa
Mirror Ball	Ballroom
Havanas	Latin

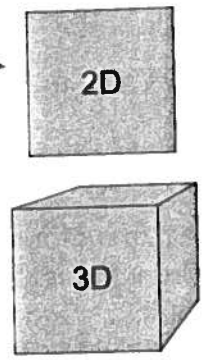
*Streetdance are only available on night 1.
Xtreme Beats are only available on night 2.

2D and 3D Objects

Objects and Dimensions

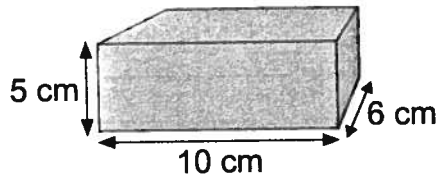
1) Some objects are flat. Flat objects are called 2D objects.
2) Some objects are solid. Solid objects are called 3D objects.
3) The dimensions of an object tell you its size.

Examples



Example

This box is 10 cm wide, 5 cm high and 6 cm deep.



The dimensions of the box are 10 cm by 5 cm by 6 cm.
This can also be written as 10 cm × 5 cm × 6 cm.

2D means '2 dimensional', so 2D objects have 2 dimensions.

3D means '3 dimensional', so 3D objects have 3 dimensions.

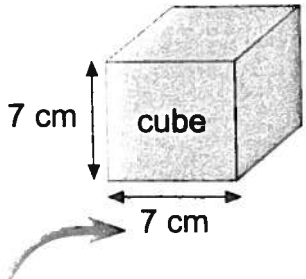
You Need to be Able to Draw Nets

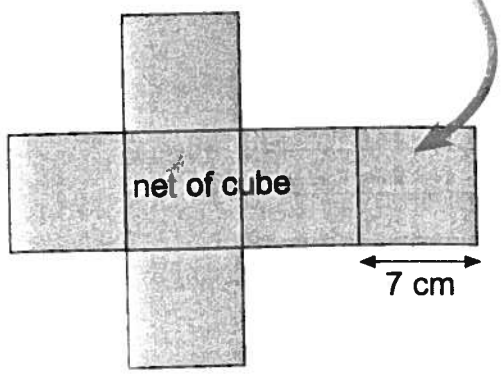
A net is just a 3D shape folded out flat. You can use a net to help you make a 3D object.

The nets for cubes and boxes always have the same basic shape.

Example 1

The cube has six sides, so the net of the cube has six squares.



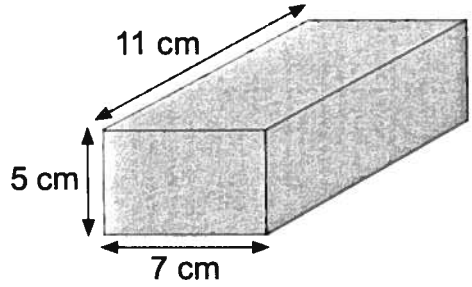


Each side of the cube is 7 cm wide and 7 cm high.

So each square in the net is also 7 cm wide and 7 cm high.

Example 2

Draw a net for the box below.



The box has 6 sides, so the net for the box will be made from 6 rectangles.

1) Draw the rectangle for the top of the box first.
   The diagram tells you it should be 11 cm long and 7 cm wide.

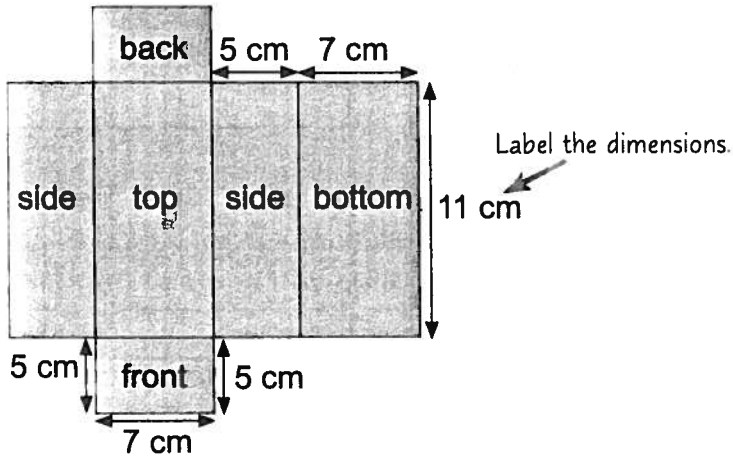
2) Next draw the rectangles for the sides of the box.
   The sides should be 11 cm long and 5 cm wide.

3) Now draw the rectangles for the front and back of the box.
   These should be 5 cm long and 7 cm wide.

4) Finally, draw the bottom of the box. The bottom of the box should be the same length and width as the top of the box.

You should end up with something like this:

net of box:



Tip: try to imagine your net being folded back up into the box.
If it works, there's a good chance you've got it right.

Practice Questions

1) Write down the dimensions of the box on the right.

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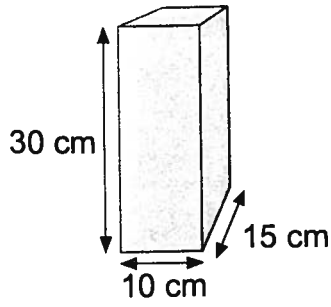
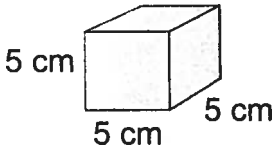
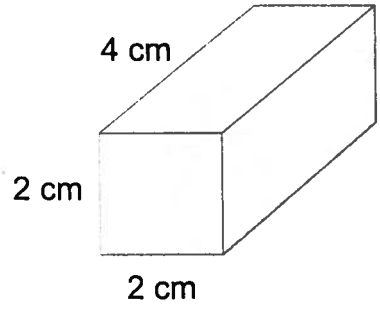
.....

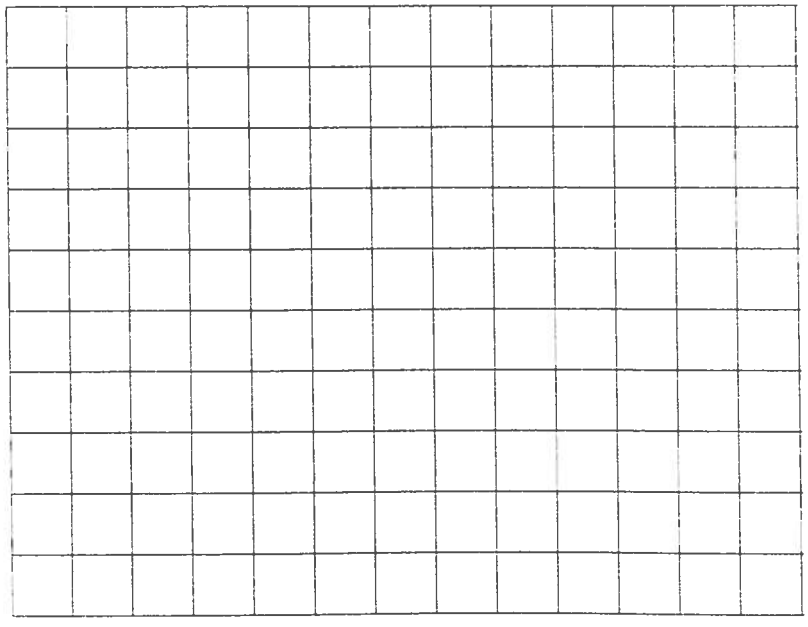


2) A cube is shown below. Sketch a net for the cube in the space on the right.
Your sketch does not need to be accurate, but you should label the dimensions.



3) Look at the box below. Draw a net for the box on the grid. Key: 1 square = 1 cm.
Label the dimensions.



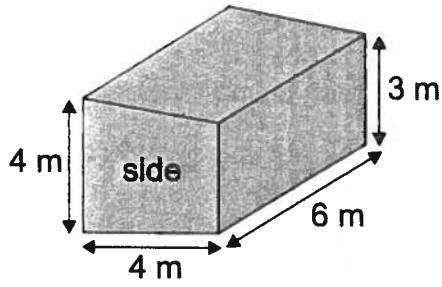


2D Drawings of 3D Objects

You might be asked to draw accurate 2D drawings of 3D objects.
The 2D drawing you do depends on what angle you're looking at the object from.

Example

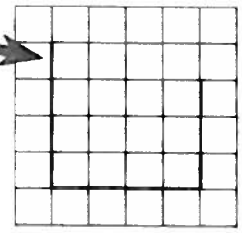
An architect is planning an extension to a house, shown on the right.



Draw the side view of the house on the grid provided.

1 square on the grid = 1 m in real life.

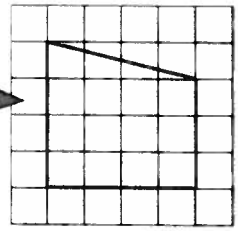
Start by drawing the dimensions you're given:



1) You know that the extension is 4 m wide. This is the same as 4 squares in your drawing.

2) You also know that the extension is 4 m high at the back and 3 m (3 squares) high at the front.

You can now draw the roof by connecting the front and back walls. Your finished drawing should look like this:

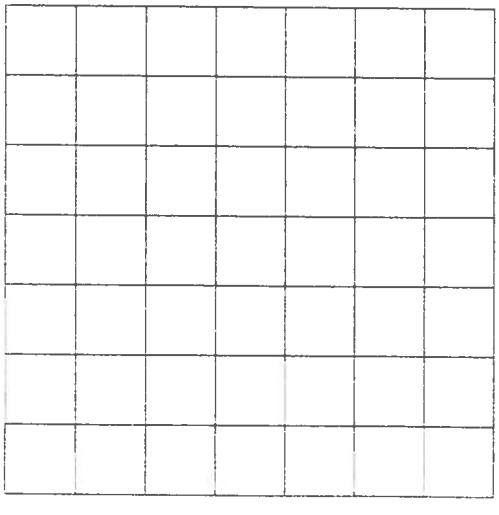


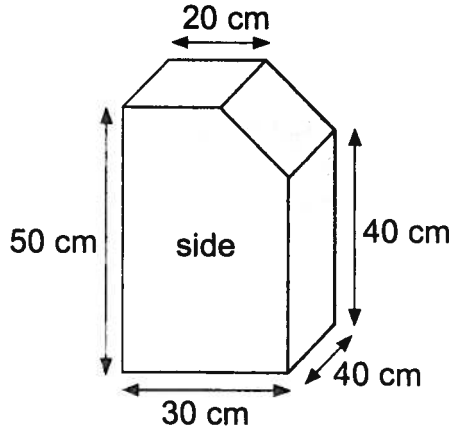
Your drawing needs to be accurate, so make sure you use a ruler and a sharp pencil.

Practice Question

1) Gwyn is planning to make a doll's house for his daughter.
A sketch of the doll's house is shown below on the right.

On the grid below, draw an accurate side view of the doll's house.
1 square on the grid = 10 cm in real life.





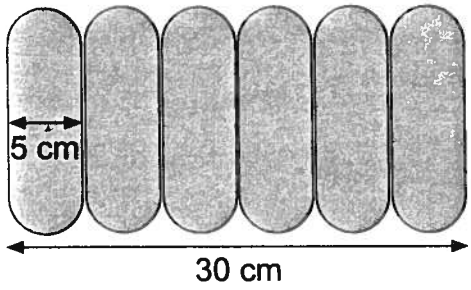
Working with Dimensions

You might get a question about 3D objects and their dimensions in your assessment.

Example

Bronwyn is designing a box to hold 6 cream cakes.
Each cake is a maximum of 12 cm long, 5 cm wide and 4 cm high.
Sketch a box that could hold the cream cakes. Label the dimensions.

Think about how you'd put the cream cakes into a box.
It would be sensible to lie them all side by side in a row, like this:



Each cream cake is 5 cm wide, so 6 cream cakes will be:

6×5 cm = 30 cm wide.

So the box needs to be at least 30 cm wide.

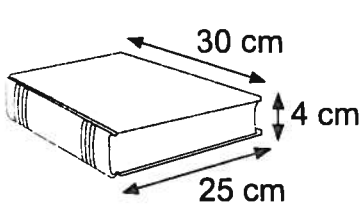
The cream cakes are all 12 cm long and 4 cm high.
So the box needs to be at least 12 cm long and 4 cm high.

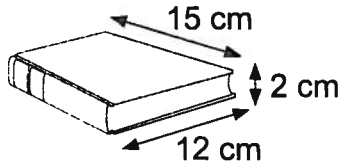
So you could sketch a box that looks like this:

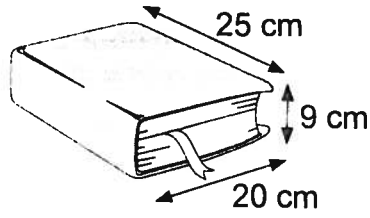
Don't forget to give the units when you're writing dimensions.

Practice Question

1) Stuart is posting some books to a friend. He wants a box to put them in.
The dimensions of the books are shown below.







Sketch a box that could hold all the books. Label the dimensions of the box.

Symmetry

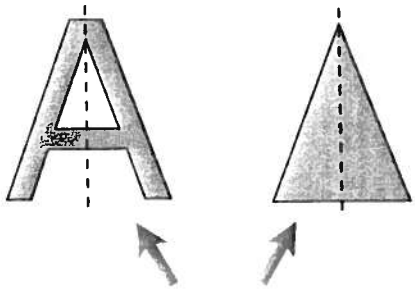
Some Shapes Have Lines of Symmetry

1) Shapes with a line of symmetry have two halves that are mirror images of each other.

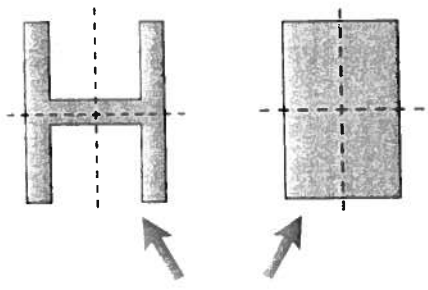
2) You could fold a shape along this line and the sides would fold exactly together.

3) Some shapes have more than one line of symmetry.

Examples



These shapes have
1 line of symmetry.

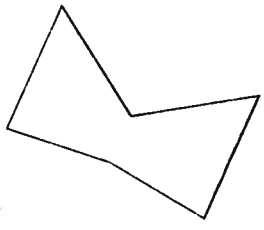


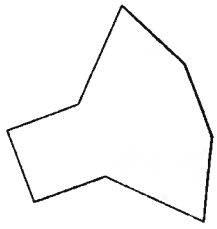
These shapes have
2 lines of symmetry.

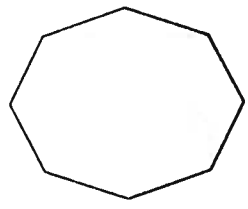
4) Some shapes have no lines of symmetry. 

Practice Questions

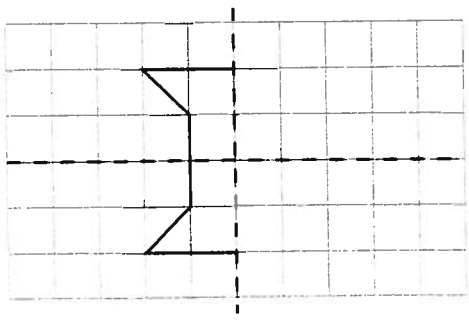
1) Draw the line (or lines) of symmetry on the shapes below:

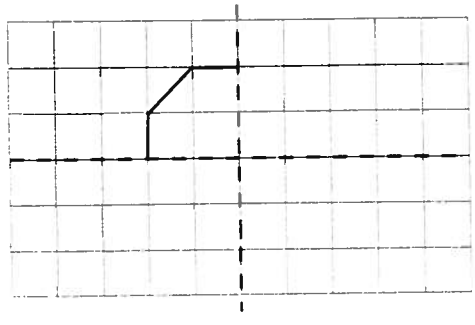
a) 

b) 

c) 

2) Complete the shapes below so they are symmetrical around the lines of symmetry.

a) 

b) 

Symmetrical Patterns Have a Line of Symmetry

1) Patterns with a line of symmetry have two halves that are mirror images of each other.

2) You need to be able to draw symmetrical patterns.

Example

Mike is making a mosaic from coloured tiles. He wants to create a symmetrical design. The tiles Mike will use are shown below.

Tile 1 Tile 2 Tile 3 Tile 4

Mike has four of each coloured tile. The rest of the tiles are white (Tile 4). Draw a symmetrical pattern that Mike could use.

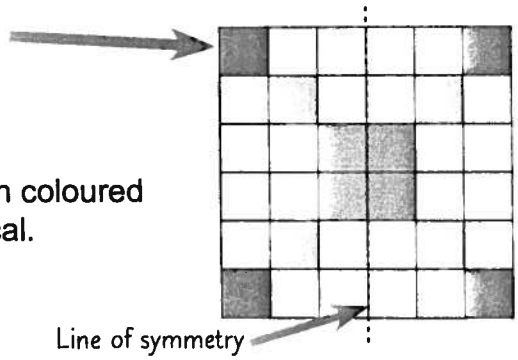
Answer:

Start by drawing a line of symmetry going through the centre of the grid.

If you put a certain tile on one side of the line, you have to put the same tile in the same place on the other side of the line.

Add the four Tile 1's first. Then add the four Tile 2's, and then the four Tile 3's. The gaps can be left white.

You might end up with something like this:



Double check that your pattern meets all the conditions in the question.

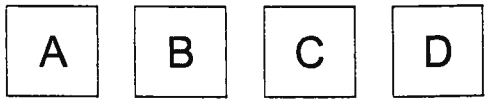
In this case, there needs to be four of each coloured tile and the pattern needs to be symmetrical.

There isn't just one right answer to this question. There are lots of different symmetrical patterns you could draw.

Practice Question

1) Kyla is tiling her bathroom wall. She wants a symmetrical design in the centre of the wall.

Kyla labels the tiles she wants to use as follows:



Draw a symmetrical design that Kyla could use in the grid on the right. You must use 4 of each type of tile.