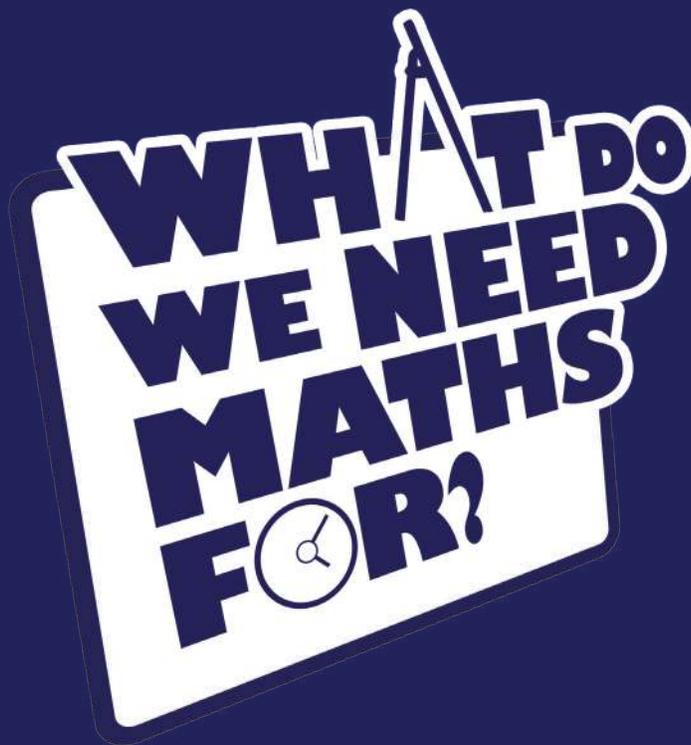


WHAT DO WE NEED MATHS FOR?

A guide to using mathematics
outside the classroom

Decorating Read
 Trips
Holidays
Business Ladders
Shopping Health



**A guide to using mathematics
outside the classroom**

Developed for the University of Bath's
Communicating Mathematics Project 2009

WHAT DO WE NEED MATHS FOR?

Why bother learning maths?

All of the maths that you learn in the classroom can be applied to real-world situations. Many of these skills will help you as you move into the world of work or buy your own car or house.

Even the maths that you can't see a particular use for at the moment can be built upon at higher levels such as A level or degree. These foundations can lead to the solution to a whole range of problems, from working out why cheetahs have spots and tigers have stripes to building skyscrapers and bridges.

Maths is an integral part of a huge number of careers and, the more confident you become with maths at school, the more doors will open up to you once you leave. Here are some examples.

Forensic Scientist
Accountant
Biologist
Businessman/woman
Doctor
Physicist
Chemist
Sound Engineer
Manager
Engineer
Interior Designer
Medical Statistician
Architect

In this booklet are a few real-world situations that use maths at home, on holiday and in the workplace. They should give you an idea of what maths can be used for in everyday life, so you should never have to ask 'What do we need maths for?' again!

Notes for teachers

This booklet has been developed to relate real-world maths to areas of the curriculum by giving examples in the following sections.

Percentages – Shopping
Perimeter and area – Decorating
Conversions – Holidays
Speed, distance and time – Road trips
Graphs – Business
Trigonometry – Ladders
Using formulae and percentiles – Health

WHAT DO WE NEED MATHS FOR?

Shopping

So why do you need to learn about percentages?

Well, percentages are one of the most common forms of maths that you find in everyday life. They can be found in adverts on TV, on the high street and on the internet. And what do they relate to?



Shopping!

Shopping is something everyone has to do. Whether it's food, clothes, computer games or shoes, everyone has to buy something at some stage.

The best time to go shopping can be when the sales are on. Many deals are on offer, but how do you know which is the best one?

If the original cost of the item is £7, which is the best deal?



three for two



2 for £10

2 for £10

2 for £10 would save you £4, compared to buying two separately.

Three for Two!

Three for Two would cost you £14 and you would get three.



30% off EVERYTHING

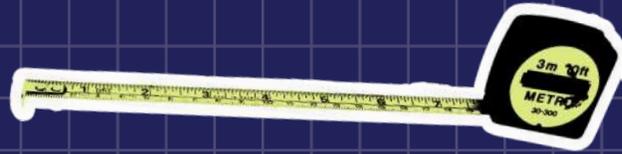
30% off Everything!

30% off would save you £2.10 per item. So if you bought one it would cost £4.90, if you bought two they would cost £9.80 and if you bought three they would cost £14.70.

If you only wanted one or two, the best deal would be 30% off but, if you wanted three, the best deal would be Three for Two!

WHAT DO WE NEED MATHS FOR?

Decorating



Why should you bother learning how to find the area of a rectangle, a triangle or a circle? Or how to find their corresponding perimeters?

Most rooms can be split up into sections made out of these three basic shapes and, once you can do this, you're in the perfect position to start decorating.

Decorating a house can be an expensive business. Paying somebody to do it for you can be even more expensive! So how can you get the best looking house for the lowest price? By buying only what you need to cut down on waste.

A standard 2.5-litre can of paint can cover 9 m^2 . If the room is 2 metres high and the doors and windows cover 4.5 m^2 , how many cans of paint will you need to cover the room?

Splitting the room up into simple shapes, you can find its perimeter. Most of this is straightforward but you will need to use Pythagoras' theorem ($a^2 + b^2 = c^2$) to work out the length of the diagonal lines.

Summing all the lengths, you get a perimeter of 18.2 m.

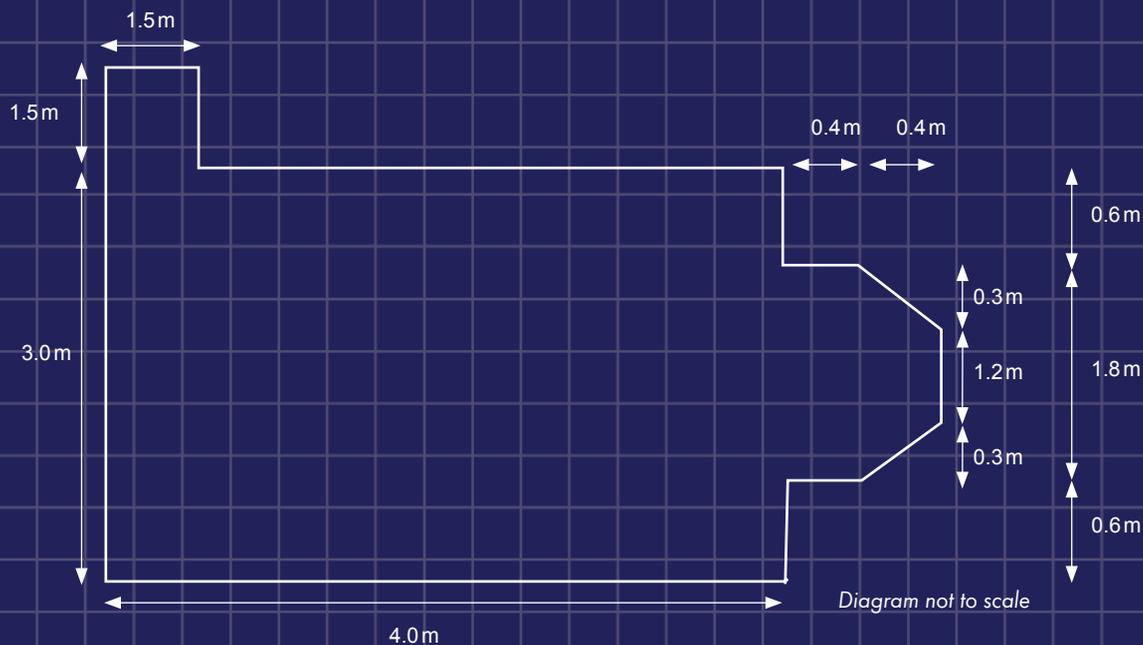
To find the area of the walls, you multiply the length (the perimeter) by the height. In this case, the length is 18.2 m and the height is 2 m. So you get an area of 36.4 m^2 . Don't forget to subtract the area that the doors and windows cover:

$$36.4\text{ m}^2 - 4.5\text{ m}^2 = 31.9\text{ m}^2$$

Finally, to work out how many cans of paint you need, you divide the area of the room by the area a can covers.

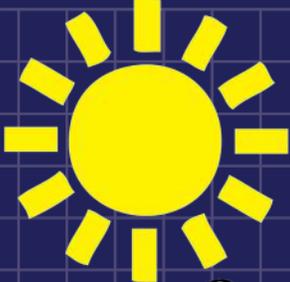
$$31.9\text{ m}^2 \div 9\text{ m}^2 = 3.544 \text{ (3 d.p.)}$$

So, to cover the room, you'll need four cans of paint!



WHAT DO WE NEED MATHS FOR?

Holidays



When would you possibly need to use conversions in the real world? Here is one situation which can involve three different types.

Going abroad is an exciting experience and guess what? You can still use maths!

Take, for example, a trip to the United States. Lots of opportunities for using maths will arise, mostly using conversions.

Let's start with money. Buying things in the US might seem more expensive than buying things here in the UK, but you have to take into account the exchange rate.



Depending on the exchange rate, £100 might get you \$144.70. So every dollar you spend in the US is worth 69p back home. This means, if you want to work out how much you're really spending, you multiply the amount in dollars by £0.69.

If you watch the weather forecast in the US you might be surprised to see that the temperatures are a lot higher than you expect.

This is because, in the US, temperatures are measured in degrees Fahrenheit, whereas here in the UK we tend to measure the temperature in degrees Celsius.

To find out how hot it's going to be, you need to use a temperature conversion:

$$C^{\circ} = \frac{5}{9} (F^{\circ} - 32).$$

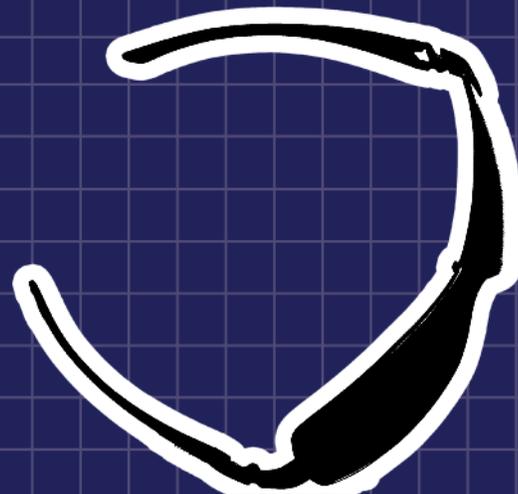
So you subtract 32 from the temperature in degrees Fahrenheit and multiply by $\frac{5}{9}$ to get the temperature in degrees Celsius.

Hiring a car can be a convenient way of travelling around the US.

However, not only will you have to get used to filling the car full of 'gas' instead of 'petrol', you will also find that gas is sold by the gallon instead of by the litre.

If you want to know how much to put in your car, you need to be able to convert US gallons to litres. 1 US gallon is equivalent to 3.78 litres.

So, to find the number of litres, you multiply the number of gallons by 3.78.



WHAT DO WE NEED MATHS FOR?

Road Trips



Do you really need to know how speed, distance and time are related?

Once you've got a car, going on a road trip is one of the best things that you can do! But once again, a few simple maths skills can help maximise your available money and comfort.

Let's take an example. If you are travelling along a motorway at 70 mph and your passenger really needs to go to the loo, how long will they have to wait if the next service station is 14 miles away?

You know the speed and you know the distance so, using $\text{time} = \text{distance} \div \text{speed}$, you can calculate:

$$\text{Time} = 14 \text{ miles} \div 70 \text{ mph} = 0.2 \text{ hours}$$

Don't forget that 0.2 hours is not 20 minutes! To find out the time in minutes, multiply the number of minutes in an hour by 0.2.

Let's say that you need to arrive at a concert at 6.30 p.m. If the time is now 5 p.m. and you have 90 miles to go, at what speed will you have to drive to reach the concert in time?

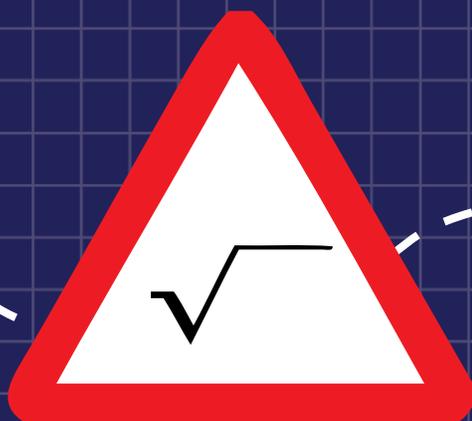
$$\text{Speed} = 90 \text{ miles} \div 1.5 \text{ hours} = 60 \text{ mph}$$

The maximum speed you can drive on a motorway is 70 mph. If there are roadworks for 15 miles of the trip with a speed limit of 40 mph, will you still get to the concert in time?

$$\text{Time} = 15 \text{ miles} \div 40 \text{ mph} \\ + (90 - 15) \text{ miles} \div 70 \text{ mph}$$

$$\text{Time} = 0.375 + 1.071 = 1.45 \text{ (2 d.p.)}$$

It will take approximately 87 minutes, or 1 hour and 27 minutes, to get to the concert. You will just make it in time!



WHAT DO WE NEED MATHS FOR?

Business

What possible use could graphs be in the real world?

Most businesses will use graphs to analyse how well they are doing and to see how they can improve. There are loads of different types of graphs, but here are some common ones.

If you owned a pizzeria, you would want to know how it was doing compared to the other pizza places in town. You can do this by looking at a pie chart (right).

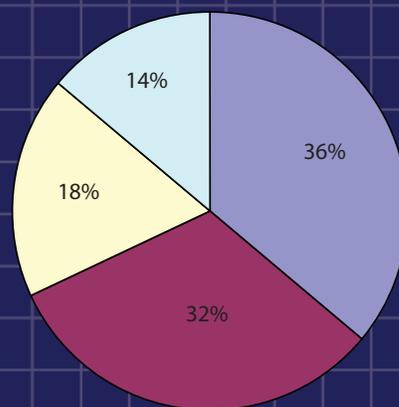
The pie chart is drawn by working out the percentage of customers that go to each restaurant in a month.

Say you run The Pizza Place. From the pie chart, you can see that this has the smallest share of customers.

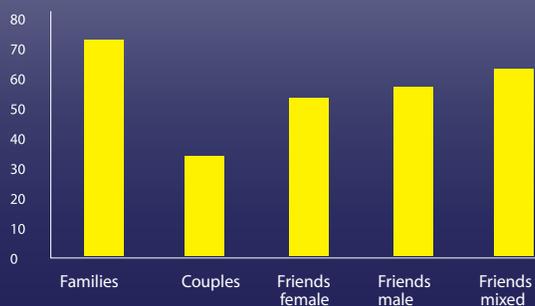
This tells you that you need to attract more customers away from the other pizzerias. One way you could do this is through advertising.

Percentage of customers in the last month

- Pizza Shack
- Speedy Pizza
- Pizza World
- The Pizza Place



Types of customer in the last month



But how will you know who to advertise to? You can use a bar chart to look at what sort of people come to your restaurant and aim adverts at the types that visit the least.

Look at the bar chart (left). From this you can see that the type of people that eat at The Pizza Place most are families. The type who eat there the least are couples.

This tells you that you might want to attract more couples to your restaurant.

WHAT DO WE NEED MATHS FOR?

Ladders

How can trigonometry be useful to you?

Well, architects and civil engineers use trigonometry all the time in their work and it can be useful to anybody who does work on their home.

Using ladders can be a dangerous business. Over 1200 people are injured by falls from ladders every year. But how does this relate to maths?

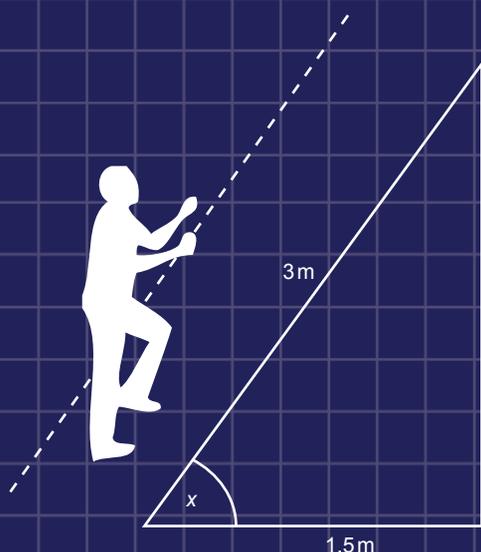
For a ladder to be safe to use, it should be at an angle of 75° to the ground. So, if you have a ladder that's 3 m long, and it has to be at 75° to the ground, how far away from the wall should the ladder be placed?

The side of the triangle you wish to know is the bottom side, in this case, the adjacent side. So the trigonometric formula you need to use is

$$\cos 75^\circ = \frac{\text{adjacent}}{3}$$

$$\text{adjacent} = 0.78 \text{ m (2 d.p.)}$$

So the ladder needs to be placed 0.78 m away from the wall.

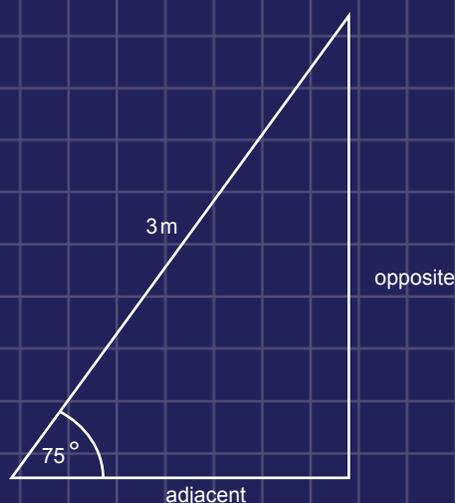


Now, if you know that you need to reach a window 3.5 m from the ground, will the ladder be long enough to reach it?

You want to know how high the ladder will reach. So the trigonometric formula you need is

$$\sin 75^\circ = \frac{\text{opposite}}{3}$$

$$\text{opposite} = 2.90 \text{ m (2 d.p.)}$$



So the ladder isn't quite long enough to reach the window.

Finally, if you place your 3 m ladder 1.5 m from the wall, will it be at a safe angle to use?

You want to know what angle the ladder forms with the ground, so the trigonometric formula you need to use is

$$\cos x = \frac{1.5}{3} = 0.5$$

$$\cos 0.5 = 60^\circ$$

So the ladder would not be safe to use.

WHAT DO WE NEED MATHS FOR?

Health



A lot of teens worry about their weight. Both boys and girls can obsess over whether they are too fat or too skinny. Using maths, you can work out if your body is the right weight for your height, sex and age.

The best way of working this out is to use your Body Mass Index (BMI). You do this by using a formula:

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

So you need to measure your exact weight (or, more correctly, mass) in kilograms and your exact height in metres.

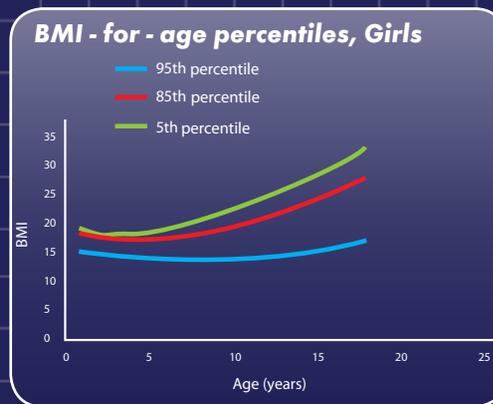
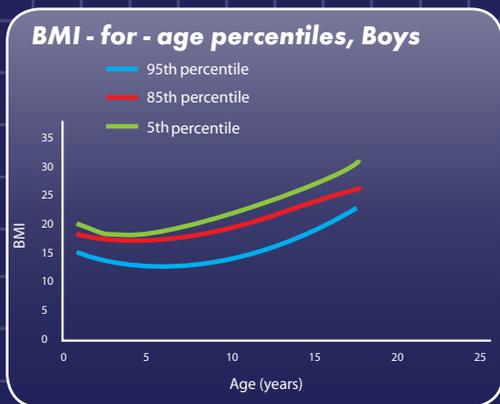
Then, with the BMI number, you need to look at a BMI percentile graph. There are two different ones: one for boys and one for girls. It is important that you use the right graph for

your sex as boys and girls grow differently and that you interpret it correctly. What is a healthy BMI for a 14-year-old girl might be unhealthy for an 18-year-old boy.

The graphs tell you whether you are a healthy weight. If your BMI is under the 5th percentile line, you are considered underweight. If your weight is between the 5th and 85th percentile lines, you are a healthy weight. Over the 85th percentile line is considered overweight and over the 95th percentile line is considered obese.

So a 13-year-old girl with a BMI of 20 would be classed as a healthy weight.

Percentiles are a way of seeing how you compare to others of your sex, age and BMI. For example, if your BMI is in the 50th percentile, then out of a 100 others of your age and sex, your BMI is the 50th largest.



WARNING

If you are worried that your BMI lies in the overweight or underweight percentiles, see your doctor. Some people grow faster or slower than others, so BMI is not always a good indication of health.

WHAT DO WE NEED MATHS FOR?



Use maths! Get ahead!

Ever thought that maths was completely useless in real life and a waste of time to learn?

If you answered yes, then this booklet is for you!

Learn about some real-life situations that could save you time and money!

Inside, tips on:
Shopping
Decorating
Holidays
Road trips

