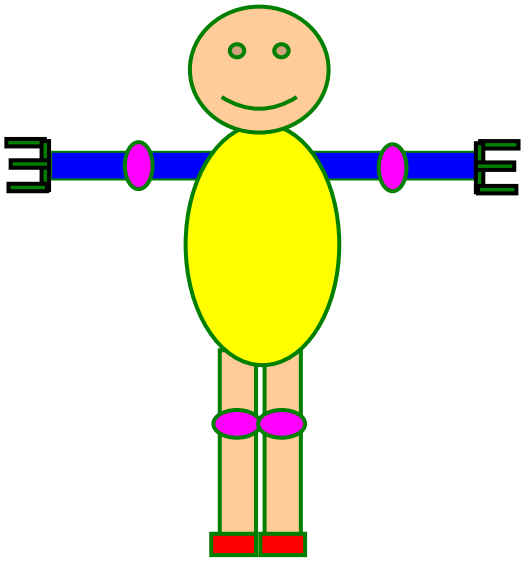
INVESTIGATION

Body Parts



MathSphere

Body Parts

Have you ever wondered why your knees are half way up your legs?

What would life be like if your knees were three quarters of the way up your leg, or one quarter of the way up your leg?

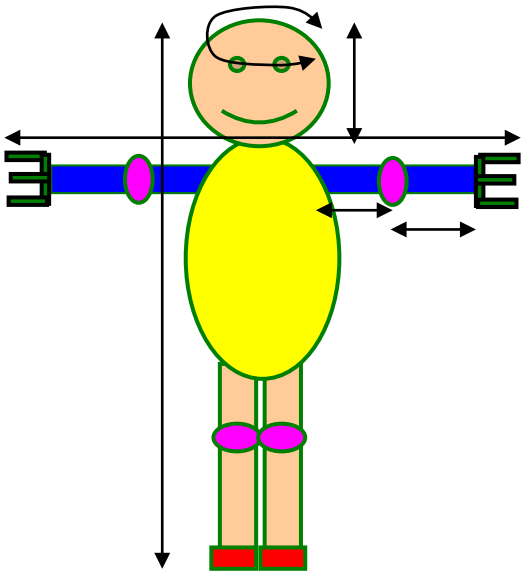
How would you feed yourself if the distance from your shoulder to your elbow was three times the distance from your elbow to your wrist?

What would life be like if your head was as heavy as your body?

In this investigation we are looking at the relationships between the sizes of different parts of your body.

You will need to measure different parts of the bodies of quite a few people of your own age and, if possible, of different ages.

You may like to start with head height, head circumference, full height, arm span (from fingertip to fingertip when arms are full stretched out), distance from shoulder to elbow, elbow to wrist, thigh to knee and knee to ankle. Think of some more of your own measurements.



You will need to record this data carefully in a proper table and make sure you have measured it correctly. It is a good idea to check your measurements.

When you have collected all your data, you will need to think how to analyse it to see if you can discover any patterns. Also think about reasons why we are made like we are.

For example, it is said that in an adult, the full height of the adult is about seven times the height of the head, but in a baby the full height is only five times the height of the head.

You could check to see if this is true. If it is true, why do you think this is so? What do babies need when they are born?

The Problem

Your task is to investigate as many relationships as possible between different parts of the body and between age groups if you have data for different age groups.

Did you know that if we kept growing at the speed we grow just before we are born, by the time we are seven years old we would be as big as St Paul's Cathedral?

Well, goodness me!

Some ideas:

Find the average (mean) of some of the measurements (such as height) in your age groups. You could do boys and girls separately and see if there is any difference. Is there a difference in height between men and women?

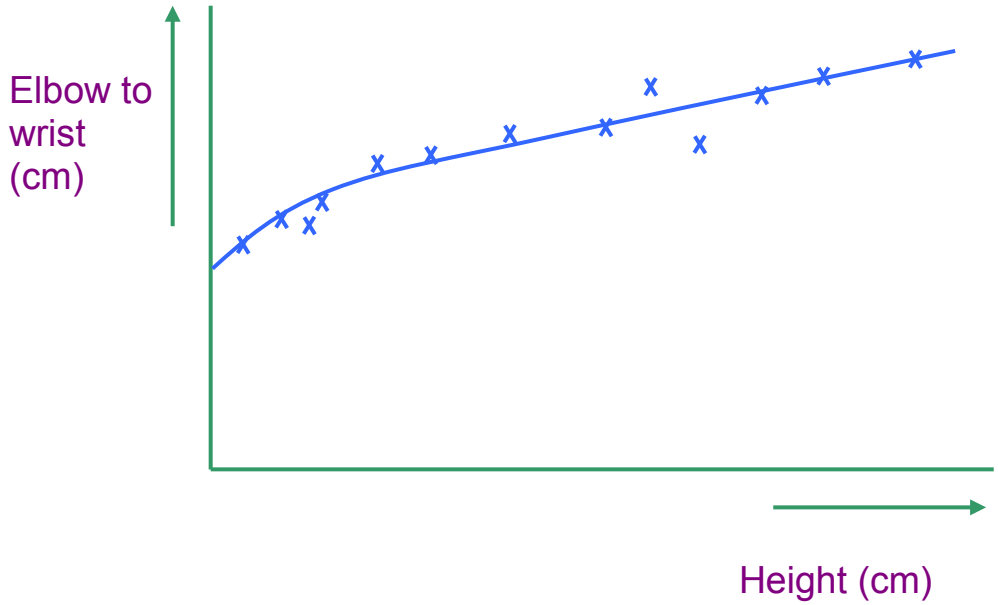
Group the data (71 - 80cm, 81 - 90cm, 91 - 100cm etc) and see how many people there are in each group. Record your results in a table and then draw a block graph.

Discuss why it is that some measurements hardly change as we get older and others change a lot.

Some more ideas:

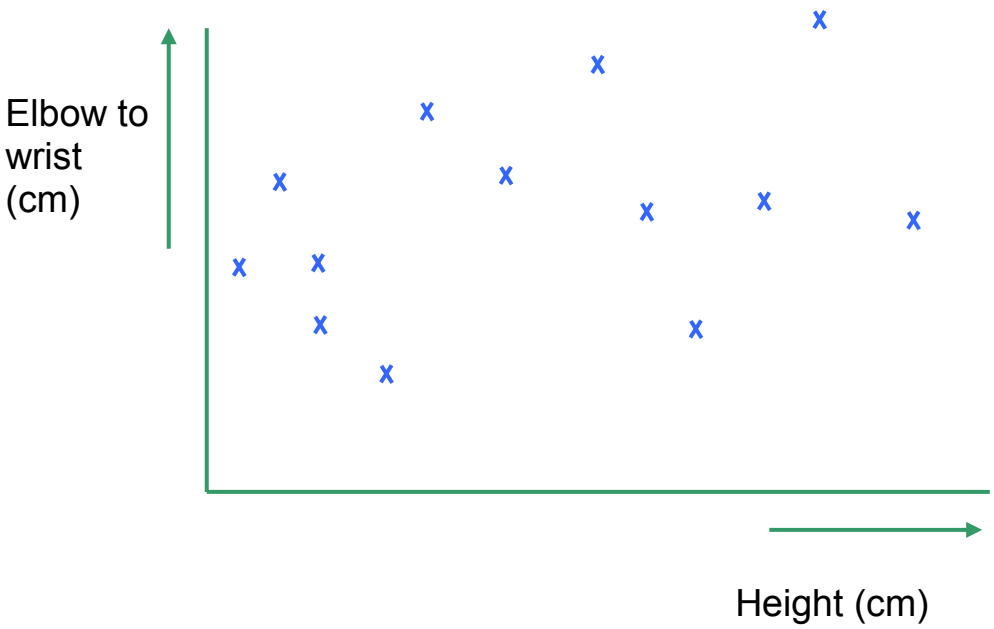
Draw scatter graphs of your results. To do this, you need to choose two measurements such as height and the distance from the elbow to the wrist.

Put one set of measurements on the horizontal axis and the other set on the vertical axis:



Put a cross for each person on the graph. You need the height and elbow to wrist measurement for each person to put the crosses on the graph.

If the crosses roughly fit a smooth curve or a straight line, we say there is good correlation between the two measurements. In other words, the two measurements are related - as one goes up the other goes up.



If the crosses do not fit on near a smooth curve or straight line as in the graph above, there is not much correlation between the two measurements. In other words, if one goes up in size, the other may not.

When you have tried looking at patterns between people of your age group, you could look to see what happens as we grow. You could do this by comparing one measurement (say height) between babies, young children, yourself, older children and adults. Do we grow steadily as we get older or do we grow in spurts?

Can you design a suit of armour that can be used by anyone in your year group?

Do not be afraid to try ideas of your own - you never know what you may discover!!

Try to find as many rules and patterns as you can.

Answer Guide

This is a terrific investigation as it can be tackled at a number of different levels, depending on the children's age and ability. It also gives plenty of opportunity for children to discover rules and to try out their own ideas. Two children sitting next to each other could end up with completely different investigations!

However, the children do need to be led at the beginning because there are two major problems with this project:

The first is to do with measurement. You need to be very sure that the children can measure to the accuracy you require of them and be confident about their measurements. Many children will measure in inches instead of centimetres without realising what they are doing. Some will start from the wrong end of the measuring tape. Others will not know how to measure a length that is longer than their measuring instrument. Some will have little idea about accuracy.

If you want to get these points over to a group a children, ask them to individually measure the length of a classroom as accurately as they can using a 150cm tape! Then see how the results compare.

The second problem arises because children are normally asked to give accurate answers to mathematical problems ($3.4 \times 6.8 = \underline{23.12}$ exactly). In this investigation they need to realise that near enough is good enough. Human bodies, although they do conform to some rules are not manufactured to high specification as a robot would be and they need to make allowances for this. For example, in a scatter diagram, it is highly unlikely that all the points will fit exactly onto a smooth curve, even when there is very good correlation and children must be able to recognise a good fit, when one exists.

There are many opportunities for extension here, including the measuring of pets to see it the same relationships hold as for humans.

The discussion about the baby's head is based on the need for babies to have large brains when they are born and therefore the head is large in relation to the body.

The suit of armour is a point for discussion. You would have a strange set of children in a class if a set of armour fitted all the children pretty well, so they can discuss how many it would fit (you can even make it out of card!). They should then be in a position to appreciate why it is that some clothes shops only cater for people in the middle range of sizes and why it is difficult for smaller and larger people to buy clothes of the right size. Further discussion could centre around how much taller people are now than in the past. The author of this piece was one of the taller people around when he was 20, but now needs to look up to his son and many of his friends!