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ACTIVITY INSPIRATION GUIDE

HOW OLD ARE TREES?

SUBJECT: **MATHS**

TOPIC: **Collecting and calculating data from trees**

Trees can be a great resource for teaching maths. After all, collecting and using data is key to mathematical understanding and there is a lot of data you can collect from trees!

'How can we tell how old a tree is?'

'How fast do trees grow?'

'What is the best way to measure a tree?'

These are just some of the questions which can help pupils put maths into practice through hands-on experiences outdoors. This approach helps to engage students, as it is much more meaningful to analyse data you have gathered yourself rather than a list of numbers you have read from a book.



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WAYS OF COLLECTING DATA FROM TREES

1) Estimate the height of a tree (three methods)

- Working in pairs: One person holds a pencil in an outstretched hand in front of them lining up the bottom of the tree with the bottom of their pencil. They then move backwards and forwards until the top of the pencil 'touches' the top of the tree. They then move the pen through 90° (to the horizontal) keeping their arm outstretched and the bottom of the pencil on the bottom of the tree. The second person then stands at the end of the pencil – making sure they move across at a right angle from the line between the pencil holder and the tree. Measure the distance the second person is from the base of the tree – this is the same as the height of the tree.
- On a sunny day take a 1m ruler outside and measure the length of its shadow. Then measure the length of the shadow of the tree you are measuring. Divide the length of the tree's shadow by the length of the meter rule's shadow to find the height of the tree in metres.
- Another fun way to measure a tree is to stand with your back to the tree. Keep your legs straight and bend over, looking up at the tree. Move backwards and forwards until you can just see the top of the tree between your legs. Measure how far away you are from the tree – this is about the height of the tree. This works because you are looking up at the tree at about a 45° angle making the horizontal and vertical lines about the same length within a right-angle triangle.

2) Measure the rate of growth (height)

This one will take you a long time but if done every year you will end up with lots of interesting data about which trees in your grounds are growing the fastest – especially if you plant new trees. You may also know when certain trees were planted so can use this information too. Factors that might affect growth rates include:



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- a. How many hours of sunlight the tree receives
- b. How much water it can access
- c. How rich the soil is in nutrients
- d. How much space the roots have to grow

3) Measure the diameter at breast height

- This is the diameter of the tree at 1.3m from the ground.
- This is a measurement used by foresters to age a tree and to calculate how much timber there is that they can harvest. Scientists use this measure to compare the growth of different trees in different places.
- You can buy special tape measures that do the calculation for you. They have two sets of numbers on them – one is the normal measurement which will give you the circumference, the other tells you the diameter.
- However, you can do the calculation for yourself instead:
 - $C = 2\pi r$ or πD so the diameter will be C/π
 - Where C is the circumference, r the radius and D the diameter.
- From this you can estimate the age of the tree. Every species grows at a different rate so you need know some information about rates of growth to be as accurate as possible. You divide the girth of the tree by the number of cm it grows each year.
- Here are some examples of how much the girth of different trees increases each year:
(from Outdoor & Woodland learning, Scotland)
 - An oak or beech's girth grows about 2.5cm per year
 - A pine's girth grows about 1.88cm per year
 - A sycamore's girth grows about 2.75cm per year



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Maths & numeracy curriculum links:

- Data collection and analysis
- Gathering, presenting and interpreting data
- Measuring including perimeters
- Estimating and rounding
- Problem solving
- Understanding rules and operations for calculations

Top Tips

- Use data collected by the whole class about one tree to reduce error – ask why is this important?
- Challenge pupils to work out different ways to measure your tree's height using trigonometry and Pythagoras' theorem?
- Use the data to draw graphs:
 - Comparing different species
 - Comparing locations – does one area have taller trees than another?
 - Compare heights and girths of trees
- You can also collect data about when the trees come into leaf or flower, or when the leaves start and finish falling.
- Or take a random selection of leaves and measure their size – especially good to do in the autumn. Can you estimate how many leaves a tree has?



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