Nutty Maths!

A selection of outdoor maths-related activities to for students aged 11-16 years and beyond

Scotland: Third and Fourth
England and Wales: Year 8,9,10, 11+
Northern Ireland: Year 9,10,11+

Trees for Life

Symmetry in Nature

How many patterns can the students spot outside? Look closely at the patterns found in nature. Are there any patterns to the way branches, leaves, seeds, flowers or petals are arranged on trees and plants? Using cameras or phones take photos of the patterns and symmetry they find in trees, plants, leaves, reflections and other natural features. Draw these or upload the photos to computers to plot lines of symmetry. Can they create some artwork on the theme of symmetry using the photos they have taken?

Can they work alone or in groups to create some symmetrical natural artwork outdoors? Can they create patterns outdoors, or with their photos, with rotational symmetry, and describe and explain the patterns?

Maps and Directions

Create a simple map of the school grounds, or local park (or your garden!), and set up a trail of objects or markers around the area, marking each one on your map. Alternatively choose natural features such as particular trees, bushes or rocks instead. At each point leave something to be collected, part of a code, a question to answer, or tree or plant to identify. Ask the students to use the maps to find all the points marked.

This can be done with or without compasses. Just make sure your map has a north arrow, and tell them which way is north with a landmark to remember it by. They can orientate their map using this, and by using the features they see around them that are marked on the map.

To find their direction of travel all they need to do is:
1. Orientate the map
2. Work out where they are on the map, and decide where to go next
3. Trace a line on the map between where they are and where they want to go, then keep the line going off the map and point in the direction of the line they have traced – this is the direction they need to go in to find their chosen point!

Alternatively, look up some local orienteering or geocaching trails.

Once students are comfortable with reading maps (paper and/or electronic), get them to make their own scale maps of a chosen space – perhaps their local park or green space. This is most accurate when done with something like a trundle wheel, but for those lacking in equipment, they can measure their steps over a known distance to get an average length of each stride and use this to approximate the distances for their scale maps.

For a satisfying round-off to the topic, get the students to plan and plot a more adventurous walk of a few miles to do together or in groups.

Tremendous Trees

Work out the height of a tree, then measure its circumference to estimate the age of the tree. There are a few ways to estimate the height – some more accurate than others! Walk away from the tree trunk, stopping every so often to bend forward and look at the tree between your legs. Stop at the point where you can just see the top of the tree. Measure the distance along the ground from you to the tree using a tape measure or trundle wheel. This is approximately the height of the tree! Get several students to do this and see what range of answers you get.

Find other ways to do this on www.wikihow.com/Measure-the-Height-of-a-Tree - try a few and compare the results or take an average.

To work out the age of a tree measure the circumference with a tape measure. Roughly every 2.5cm of circumference represents 1 year of growth (though this varies by species). So, to estimate the age of the tree in years, divide its circumference by 2.5.

Can the students find the oldest and youngest trees? Can they measure a few trees to find the average age? Can they find a tree their age?

Some students may also be able to work out the radius from the circumference (C=2 πr). Use this to work out the area of a cross section of the trunk using the formula $A = \pi r^2$, then work out an approximation of the volume of the trunk using this area and the trunk height.

To find the height of the trunk rather than the full tree, use any of the methods described on the Wikihow page, but measuring only to the top of the trunk, not the highest branches.

Canopy Calculations

This activity ties in well with learning about photosynthesis, and with the tree size and age calculations in the previous activity.

Get the students to make estimates before deciding how to get more accurate measurements, then compare the estimates to the answers.

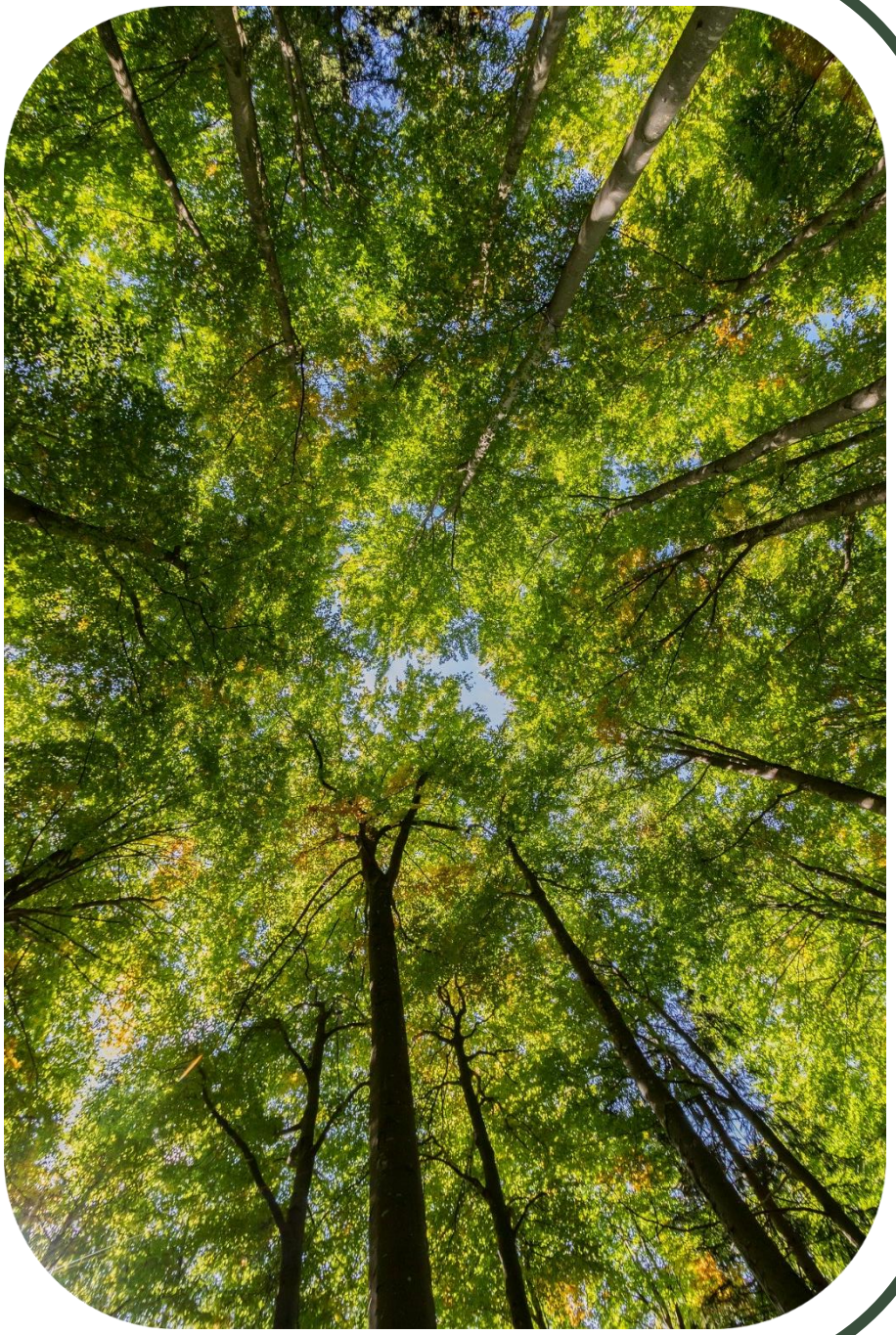
How close do trees grow to each other? Measure with footsteps or tape measures and plot them on a map or on graph paper.

Compare the shape or area of different tree leaves – what might the size mean for photosynthesis and how do trees – and other plants - maximise the amount of sunlight they can capture?

While there are still leaves on the trees, look at the canopy – how much is covered by leaves and how much is open, letting light through? Use grid paper to plot this and work out the canopy perimeter and area, and approximate the percentage of canopy coverage.

Do this for different trees and compare them – do different trees have different canopy sizes or coverages? Does canopy size or coverage depend on a tree's age or species? Think about how canopy cover affects what grows beneath the trees.

You can link in some great biology-themed investigations here too.



Data and Graphs

There are so many options in the outdoors for making predictions, taking measurements and displaying data. Different kinds of graphs work best with different kinds of data; get the students to think about the best way to present each type of data, thinking about how the graph will be used.

Take a look at the weather forecast, make predictions, then measure rainfall over a series of days or weeks. Log and graph the results. Did the predictions match the results?

Plant a seed and watch it grow, taking measurements at regular intervals. Compare the rates of growth of different plants, or different species. You could also compare rates of growth of the same type of plant in different soils, or with different amounts of light. Introduce the control of variables here, varying one thing at a time, to give clearer results that conclusions can be drawn from.

Do the angles of flowers, leaves or plants to the sun change throughout the day? How could this be measured? Data can also be collected on things like temperature, wind speed, tar spot fungus on sycamore trees (e.g. does this relate to distance from roads or built-up areas?) and plot these to see change over time or make comparisons. Encourage students to work alone or in groups to formulate their own predictions, design experiments, collect data and analyse results, choosing appropriate methods of display, and drawing conclusions to be compared to their initial predictions. Students could display or present their mini projects for other groups or classes. Also encourage them to consider how their studies could be continued, followed-up or improved.

Thanks for reading, we hope you enjoy these activities! Be sure to take a look at our website where you'll find more resources and lots of information about our different projects and the flora and fauna of the Caledonian Forest.

You can also find updates, photos and videos on Facebook, Twitter, Instagram and YouTube!

Trees for Life | Rewilding the Scottish Highlands
Ath-fhiadhachadh na Gàidhealtachd