Activity 2 – Tree trigonometry

Use Pythagoras' theorem to measure the height of trees in a woodland.

Use this maths activity to fulfil the **Plant trees with your school** challenge. Order a free tree pack and send us a photo of your trees being planted, along with details of the event.

www.woodlandtrust.org.uk/support-us/act/your-school/plant-trees-with-your-school/

If you're not able to plant trees at school, you can plan a virtual tree planting instead using our interactive planning tools. Just send us your plans and evidence.

Worth two points on the award.

You can also use this activity to fulfil the **Visit a wood** challenge, also worth two points on the award.

www.woodlandtrust.org.uk/support-us/act/your-school/green-tree-schools-award/visit-a-wood/

Curriculum requirements KS3

Students should have the opportunity to:

- use Pythagoras' theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles

- use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3D.

Learning outcomes

After completing this activity, students will:

- understand and use Pythagoras' theorem to solve the real-life problem of measuring the height of a tree

- be able to explain why tree height is useful for looking after British trees and woodlands and how maths is used by site managers.

Maths - KS3

If the extension activity is completed, students will also:

- be able to choose mathematical methods to work out the volume of a tree.

Preparation and resources

The following materials will help deliver this activity successfully.

Outdoors – in a local woodland, park or your school grounds

- risk assessments

- health and safety equipment

- outdoor clothing and footwear suitable for all weathers

In the classroom

- AV equipment to show the film 'Meet the people behind our work' **www.woodlandtrust.org.uk/about-us/what-we-do/people-behind-our-work-friends-of-belvoir-wood/**

- 30-metre tape measures and clinometers (one of each between four students)

- clipboards and pencils

- printed copies of the Woodland Trust's tree identification resources **treetoolsforschools.org.uk/activitymenu/?cat=tree_id**

Location

Different parts of this activity can be carried out in different places.

On a woodland visit

If possible, go to a local woodland to complete this activity using the trees there.

In your school grounds or local park

Alternatively, go into your school grounds or a local park with trees before or as part of your lesson.

In the classroom

The main activity cannot be done in a classroom with a real tree. However, if an outside visit is not possible a pretend tree could be drawn on paper and Pythagoras' theorem used.

Starter activity (10 minutes)

Outdoors

Use our tree identification resources to identify trees. Ask each student to choose one tree and identify it by its leaves, fruit, flowers or bark.

Indoors – watch our video: Meet the people behind our work

Use the film to introduce students to the role of a site manager. Ask students to discuss in pairs why they think a site manager needs to measure the height of trees.

(Possible answers: safety, survey of woodland, using the wood for timber, to determine the health of the tree.)

Main activity (40 minutes)

Students should work with the scenario that the Woodland Trust site manager has asked them to help her measure the height of trees in the woodland, school grounds or park. She is doing a survey of every tree to make sure she can look after them as part of her job.

Students should get into groups of three or four. They should work out which maths method might help measure the height of the tree if we assume the tree trunk is at right angles to the soil.

(Answer: Pythagoras' theorem.)

Students should choose one tree they want to measure. Ensure they stand next to it at its base. Pupil one should stand at the bottom of the tree with a clinometer and carefully walk backwards away from the tree in a straight line, keeping the clinometer's sight line in line with the top of the tree. Pupil two walks with the first pupil and makes sure they don't fall over as they walk backwards. Pupil two also watches the clinometer's wheel. When the arrow points to 45 degrees on the clinometer wheel, both pupils should stop walking.

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Pupil three should use the tape measure to measure the distance (from pupils one and two to the base of the tree. This distance is equal to the height of the tree minus the height of pupil one to their eyes (as the 'triangle' has to finish at their feet, not their eyes). Pupil one then adds their actual height to the distance from the tree and this gives an accurate measurement of the tree height.

On clipboards or in the classroom, students should produce a scale drawing of their tree.
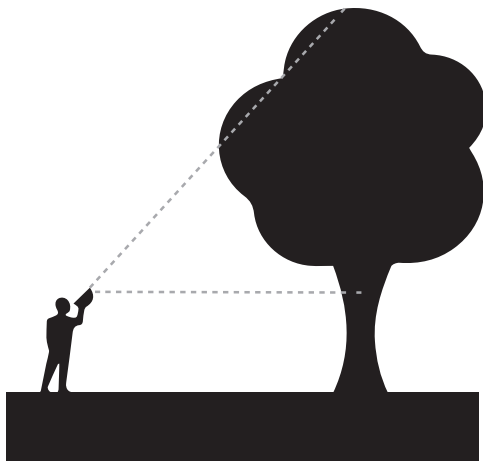
Plenary/evaluation (10 minutes)

To end the lesson, students should share the species of their trees and their heights. They should think of other scenarios in which a woodland site manager would use maths as part of their job.

(Possible answers: working out the diameter of a tree to age the tree, the number of trees in a hectare, the area of woodland needing protection.)

Extension

Students can further test their geometry knowledge to work out the volume of a tree.

(Answer: use volume of cylinders and cones, as well as height measurement.)

Using the clinometer