Teachers Notes

How to find the height of a tree.

There are a variety of methods to do this using the skill processes of **estimating, measuring** and **calculating**.

Method 1

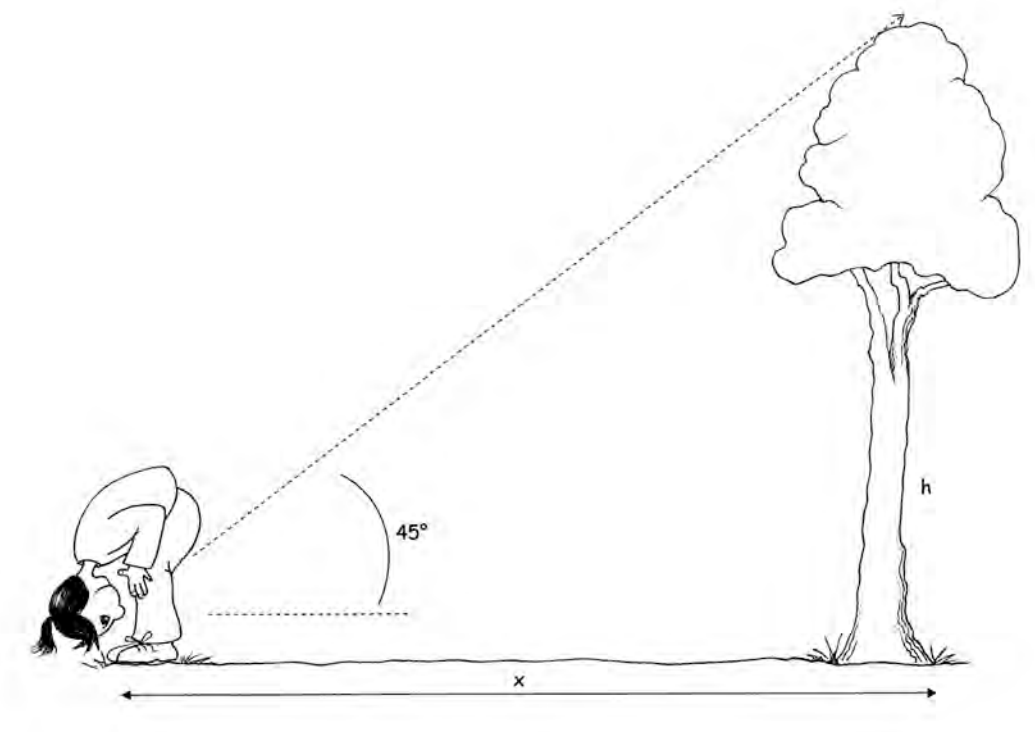
The simplest way is by **estimating** the height just by looking at the tree from a distance or comparing it with surrounding structures whose height is known. Children can do this initially and it will indicate how aware they are of the **order of magnitude** of the size of objects.

Once recorded they can then use increasingly sophisticated methods to improve their **accuracy**.

Method 2

This relies on **trigonometry** (and suppleness!) and the fact that if you view a tree top at a 45 degree angle then the height of the tree is equivalent to the distance that you are from that tree.

Walk away from the tree but at regular intervals bend forward and look through your legs back to the tree. Stop when you are at a point where you can just see the top of the tree and **measure** the distance along the ground from the tree to you. This is roughly equal to the tree's height.

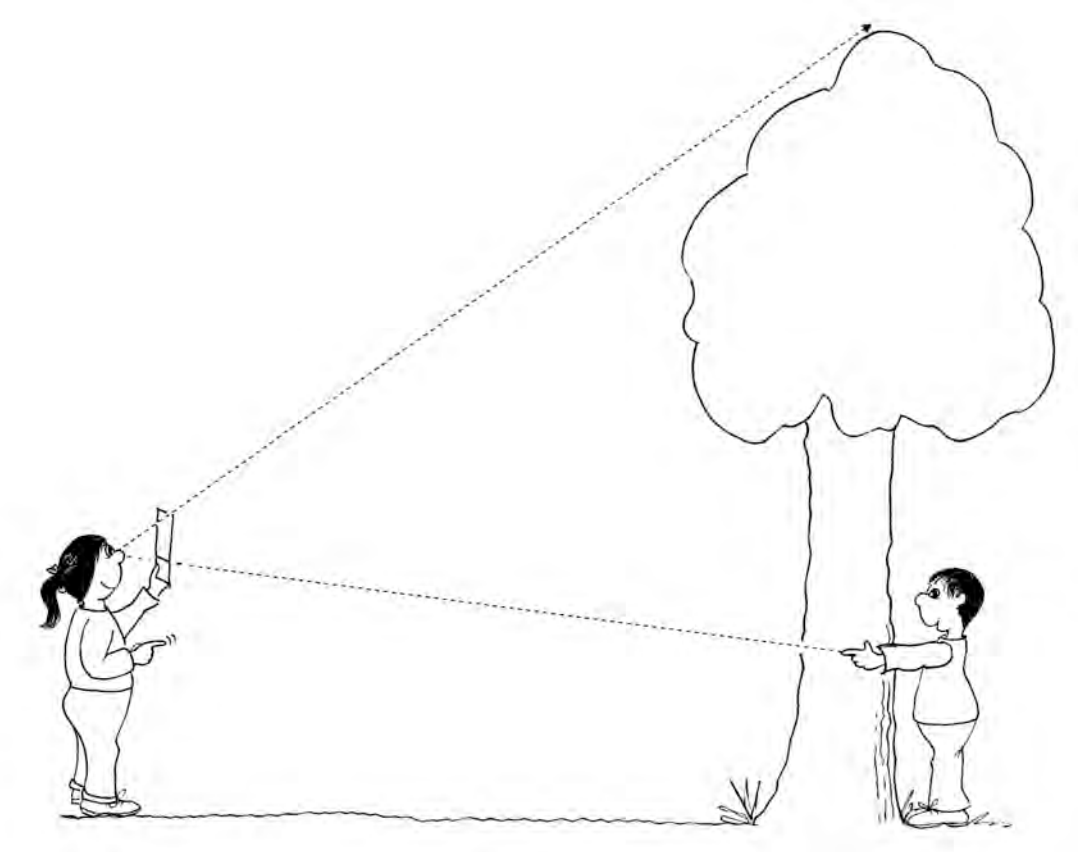


Method 3

Ratio stick. Cut a strip of card so that it is exactly 30cm long and approximately 3-4 cm wide. Exactly 3cm from the bottom draw a line or arrow across the whole width (see figure x). You are now ready to **calculate** tree heights.

In pairs, one person stand by a tree, the other with the card move away from the tree. Hold the card at arms length in front of your eyes until the top of the card is seen to just cover the top of the tree and the bottom is in line with the ground. Now direct the person by the tree to place their hand on the trunk and move it up and down until it is in line with the 3cm mark on the card. Return to the tree and **measure** the distance of the person's hand on the trunk from the ground.

As the hand was 1/10 along the card (3cm line is a tenth of 30 cm), the tree height must be 10X the distance measured between the ground and the hand.



Method 4

This is a method for a sunny day. Place a metre ruler upright on the ground and locate its shadow. Along the length of the shadow place a piece of ribbon or tape. This is now a "shadow metre" and can be used to **measure** the shadow of the tree in metres. But remember this will only

work at this instance in time as the shadow metre will change with the time of day and the season. So to be really accurate mark the tip of the tree's shadow at the same time as you make the shadow metre. It may be interesting to try this at different times of the day or the year to see the variation and direction of shadows.

Method 5

Make a clinometer. This is a device that also relies on **trigonometry**. A simple model can be made with a paper plate, a straw (or empty pen tube), some string and a weight (plasticine/washers).

Cut the plate in half and glue a straw or an empty pen tube along the cut edge. This is a sighting guide. Exactly half way along the cut plate edge stick a piece of string with a weight on the end so that it dangles beyond the edge of the plate. See figure 2

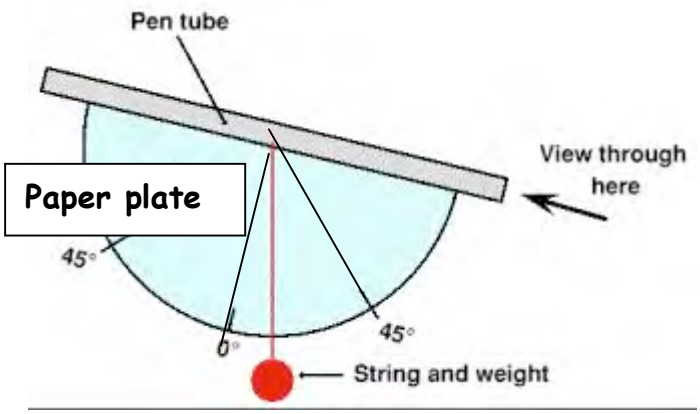
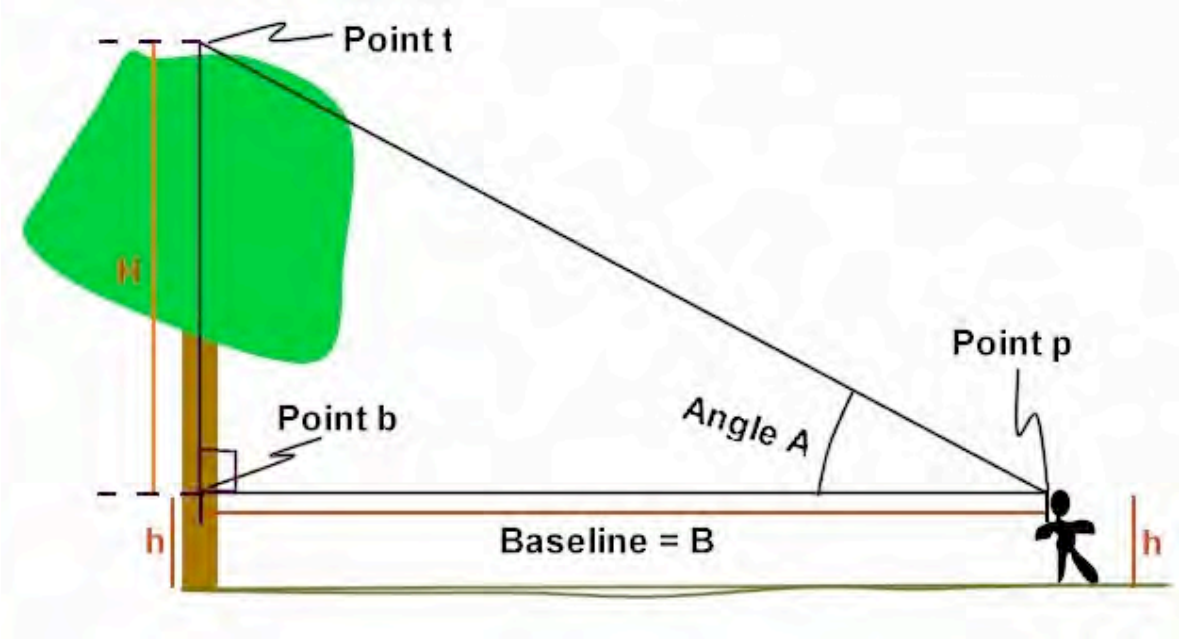


Figure 2. Paper plate clinometer

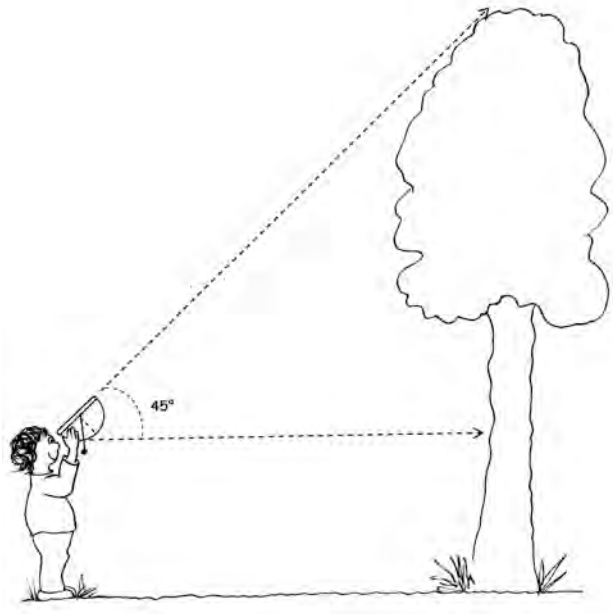
You now need to be able to find the line that is **45°** to the straw. If there is a pattern of crenulations along the outer curved edge of the plate it may be possible to **calculate this position**. Count the crinkles and locate the middle one. A line from here to where the string is attached will be 0°. A **position** exactly half way between 0° and the cut edge of the plate is 45°. Alternatively use a **protractor** (in fact the clinometer can be made using a protractor to replace the paper plate).

Now look through the straw so that the treetop is visible. Walk backwards away from the tree keeping the top in the sights. Your partner will need to follow you and note when the weighted string lines up with the 45° line. Stop and **measure** the **distance** that you are from the tree. This **distance** is equal to the height of the tree less your height. So find out how tall you are, **add** this to the distance from the tree and you have an **accurate measurement** of the tree height.



In the diagram above (courtesy of Offwell Woodland & Wildlife Trust at www.countrysideinfo.co.uk) if angle A = 45° then H=B. So to find the tree height, (H+h) you must add B+h.

Tree height = B + h



Ideally pupils could try some, or all, of these methods to determine the accuracy of each one. A pupil's sheet is available for this purpose.