

Introducing Trigonometry

I have used a somewhat unconventional (and maybe backwards) approach to introducing trigonometry, but it seems to work ok.

Before starting on trig, I make sure students are comfortable with measuring slopes as angles and as gradients and with calculating any of rise, run and gradient from the other two. Then I ask the students to estimate various slopes like the slope of a street in the neighbourhood, the slope of the stair railing, the slope that is needed for a desktop to be impossible to walk up etc. [Be careful, the legs fell off my desk once while doing this part.]

I ask them to give the slope as both an angle and a gradient. We measure some of these. Students seem to realise intuitively that for a given angle, there is only one possible gradient and that for a given gradient there is only one possible angle.

To save measuring both, we produce a conversion table between angle and gradient. This can be done by the students with a wooden rod (eg a metre rule) and a clinometer (or even a protractor, though less accurately) by propping the rod against the wall at various angles and measuring the distance up the wall to the top of the rod, the distance across the floor to the base of the rod, and the angle between the rod and the floor.

This table of values can then be used to find the height of a tree or building using a clinometer and a trundle wheel (or other measuring device). The students find the angle to the top of the tree, convert it to gradient form and then use the gradient and the horizontal distance to calculate the height.

What we have produced of course is a table of tan values, and they are pleased when I can give them a ready-made table for every number of degrees from 0 to 89 accurate to 2 or 3 decimal places. They are even more pleased when they discover that their calculator can do even better.

From there we do various practical, then pencil and paper, exercises using tan ratios, firstly involving height, but then with triangles in other orientations also. The idea of opposite and adjacent sides comes out of these exercises and provides a way of thinking about the triangles without having to turn the paper round.