Trigonometry lesson 3

Same shape triangles

Lesson overview

In this activity students use practical measurement skills and ratio calculations to find a pattern linking the ratio of sides of a triangle with the angles. This lesson is designed to develop the concepts of sine, cosine and tangent ratios of angles.

Students should:

1. have a knowledge of the concept of ratio
2. have the ability to convert fractions to decimals using a calculator to 3 decimal places
3. be able to measure the length of sides of triangles to the nearest millimetre

Grouping

Step 1: whole class

Step 2: groups of 3 or 4 students

Step 3: whole class

Outcomes

MS5.1.2 (p 139) Applies trigonometry to solve problems (diagrams given) including those involving angles of elevation and depression

WMS5.1.4 Explains and verifies mathematical relationships

Individual student materials

- pencil
- ruler
- calculator
- scrap paper

Group materials

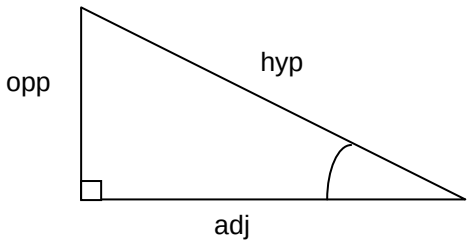
- one set of triangles per group. *Triangle sheets A-G* should be photocopied onto coloured cardboard. Carefully cut out the triangles and place each set (8 triangles in a set) into plastic bags.
- One *Calculating ratios for similar triangles* worksheet per group

Class materials

- Three large charts (enlarge to A3) – one for each ratio (opp/hyp, adj/hyp and opp/adj) - for a class graph
- At this point only label the graphs with the ratios – introduce the trig names sin, cos and tan at the end of this lesson

Step 1

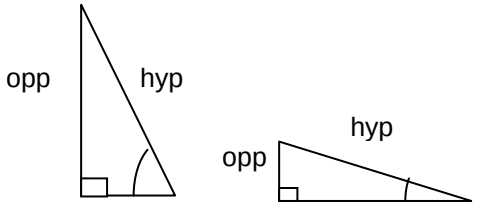
- Show the students a large right-angled triangle with one angle marked



- Remind the students about the hypotenuse (from Pythagoras' theorem) and show them the opposite and

Questioning

- *What is the hypotenuse of a right-angled triangle? Where do you find it?*
- *What is ratio?*
- *What happens to the opp/hyp ratio when the angle is large?*
- *What happens to the opp/hyp ratio when the angle is small?*

adjacent sides in relation to the marked angle • Discuss the meaning of the words *opposite* and *adjacent* in this context • Practice labelling right-angled triangles from the board, OHP or use *Labelling right-angled triangles* sheet • Explain that the lesson involves investigations of the ratios of pairs of sides of right-angled triangles with angles of different sizes • Discuss the word *ratio* and what it means in this context • Compare opp/hyp for a very large and a very small angle, as shown in diagram, and have students estimate which one will have the larger ratio 	
Step 2 • Divide class into groups of 3 or 4 students • Hand out one *Calculating ratios for similar triangles* worksheet and a set of triangles to each group • Each student takes two triangles. They measure each side to the nearest millimetre and complete the worksheet for their triangles writing the ratios as a fraction and using a calculator to estimate them to 3 decimal places • Each group completes the worksheet including the mean values for each ratio to 2 decimal places • Members of the group stack their triangles as neatly as possible on top of each other and discuss their findings	**Check that students:** • are measuring correctly to the nearest millimetre • can convert fractions to decimals on the calculator • can approximate a decimal to 3 decimal places • understand how to find the mean value • can plot the mean value for their groups set of triangles on the class graphs • pronounce the trig ratios correctly eg. sin is pronounced ‘sine’
Step 3 • When every group worksheet is completed, one member of each group brings it forward with their group’s stack of triangles and briefly reports their findings • Each group now plots its mean values on the three class graphs. At this stage,	**Discussion** *What did your group find when you stacked the triangles on top of one another?* They should discover that triangles with the same angles have approximately equal ratios

do not join the plotted points as the next lesson will add more values to the graph. • Class discusses graphs o Note the fact that triangles which have the same ratios also have the same angles o This is the basis for scale drawings where although the triangles are different sizes, the angles are in the same proportion or ratio o Explain to students that these ratios have special names: ▪ opp/hyp is **sine** of the angle (sin) ▪ adj/hyp is **cosine** of the angle (cos) ▪ opp/adj is **tangent** of the angle (tan) ▪ these ratios are used in a branch of mathematics called **trigonometry** or **trig** for short o Where have you heard the word trig before? (possibly trig station,…)	*What information can you observe from each graph?* They should be able to see that the ratio increases as the angle increases for the opp/hyp graph; the ratio decreases as the angle increases for adj/hyp and the ratio increases as the angle increases for opp/adj *What occupations use trigonometry in their jobs?* All kinds of engineers, navigator, surveyor, architect, air traffic controller, cartographer, landscape architect, meteorologist, electronics designer, oceanographer, roofing contractor, marine engineer, geologist and sheet metal, heating and air-conditioning engineers. *Where is the word trigonometry derived?* The word trigonometry is derived from two Greek words meaning ‘triangle’ and ‘measurement’