*You might want to get a collection of set squares to reference*

A typical geometry set contains two set squares. Both set squares contain a right angle. But one set square is a 45°, 45°, 90° triangle, and the other is a 30°, 60°, 90° triangle.

*The following set of tasks could be carried out with one set of triangles at a time.*

**Task One**

Use centimetre square dotty paper to draw a 45°, 45°, 90° triangle. Now draw another 45°, 45°, 90° triangle that is a different size. And another, and another. Draw at least five of different sizes.

Use centimetre triangular dotty paper to draw a 30°, 60°, 90° triangle. *HINT: A 30°, 60°, 90° triangle is half of an equilateral triangle*. Again, draw at least five different-sized 30°, 60°, 90° triangles on the sheet. Make a copy of this sheet as you need two sets of these triangles.

**Task Two**

*This task involves calculation with surds and could be carried out with or without a scientific calculator depending on what you are trying to achieve.*

Take your sheet of 45°, 45°, 90° triangles. In each triangle:

* Label the right angle
* Label **just one** of the 45° angle
* Label the length of the shorter sides
* Use Pythagoras’ theorem to work out, and label, the length of the hypotenuse. Leave the answer in surd form\*.

Take one sheet of 30°, 60°, 90° triangles. In each triangle:

* Label the right angle
* Label the 30° angle
* Label the two sides that are integer lengths
* Use Pythagoras’ theorem to work out, and label, the length of the missing side. Again, leave the answer in surd form\*.

Take the second sheet of 30°, 60°, 90° triangles. In each triangle:

* Label the right angle
* Label the 60° angle
* Label the lengths of the three sides

\* Surd form means ‘as a square root’. If you are using a scientific calculator it might do this automatically.

**Task Three**

The longest side of a right-angled triangle is always opposite the right angle. It is called the hypotenuse. The other sides of a right-angled triangle can be labelled with reference to one of the other angles.

28°

*hypotenuse*

*opposite*

*adjacent*

The **opposite** side is opposite the angle you are interested in.

The **adjacent** side is next to the angle you are interested in.

Take your sheet of 45°, 45°, 90° triangles. You should have just one 45° angle labelled. In each triangle:

* Label the opposite side
* Label the adjacent side
* Label the hypotenuse

Repeat this for the 30°, 60°, 90° triangles that have the 30° angle labelled.

And repeat again for the 30°, 60°, 90° triangles that have the 60° angle labelled.

**Task Four**

Make a copy of this table. It needs one row for each of your 45°, 45°, 90° triangles.

|  |
| --- |
| **The 45° angle** |
| **Triangle** | **Opposite** | **Adjacent** | **Hypotenuse** | **O ÷ H** | **A ÷ H** | **O ÷ A** |
| 1 | 1 cm | 1 cm | √2 cm |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Record the lengths of the three sides of each triangle.

Work out the value of opposite ÷ hypotenuse, adjacent ÷ hypotenuse and opposite ÷ adjacent for each triangle. Leave you answer in surd form if appropriate.

Repeat this for the 30°, 60°, 90° triangles that have the 30° angle labelled.

And repeat again for the 30°, 60°, 90° triangles that have the 60° angle labelled.

Write about what you notice.

**Task Five**

If a right-angled triangle has a 30° angle then it is **always** true that opposite ÷ hypotenuse = 0.5

When looking at the 60° angle it is always true that opposite ÷ hypotenuse = $\frac{\sqrt{3}}{2}$ (or 0.866…)

For a 45° angle opposite ÷ hypotenuse = $\frac{\sqrt{2}}{2}$ (or$\frac{1}{\sqrt{2}}$ , or 0.707…)

Every angle has a value for opposite ÷ hypotenuse that never changes. This value is called the **sine** of the angle. This is written as sin30° = 0.5.

You calculator has a ‘sin’ button. Check that you are in ‘degrees mode’, and use it to work out sin30°. Then try sin60° and sin45°.

You have also seen that the value for adjacent ÷ hypotenuse is fixed each angle. This is the **cosine** of the angle. Cosine is abbreviated to cos. Check these values using your calculator.

The opposite ÷ adjacent value is called the **tangent** of the angle (or tan). Check these on the calculator too.

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The set square’s angles of 30°, 45° and 60° are special cases. Every angle has a sine, a cosine and a tangent.

The triangle on the previous page was labelled with a 28° angle. Use your calculator to find sin28°, cos28° and tan28°.

* If the hypotenuse was 10 cm, how could you work out the length of the opposite side?
* If the adjacent was 7.5 cm, how could you work out the length of the hypotenuse?

**To conclude**

You will need to learn these trigonometric connections for any angle θ. How does your memory work?

|  |  |
| --- | --- |
| $$sinθ= \frac{opposite}{hypotenuse}$$ | θ°*hypotenuse**opposite**adjacent* |
| $$cosθ= \frac{adjacent}{hypotenuse}$$ |
| $$tanθ= \frac{opposite}{adjacent}$$ |

SOHCAHTOA: **S**ome **O**f **H**arry’s **C**ats **A**re **H**eavier **T**han **O**ther **A**nimals