

Exact Trig Values

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Use half an equilateral triangle of side 2 to find $\sin 30^\circ$, $\cos 30^\circ$ and $\tan 30^\circ$.

Step 1 · Cut the triangle in half: base 1, hypotenuse 2

$$\text{Height} = \sqrt{(2^2 - 1^2)} = \sqrt{3}$$

Step 2 · The 30° angle is at the top; opposite it is the side 1

$$\sin 30^\circ = 1/2, \cos 30^\circ = \sqrt{3}/2$$

Step 3 · $\tan = \text{opp} \div \text{adj}$

$$\tan 30^\circ = 1/\sqrt{3} = \sqrt{3}/3$$

Answer: $\sin 30^\circ = 1/2$, $\cos 30^\circ = \sqrt{3}/2$, $\tan 30^\circ = 1/\sqrt{3}$

Check: $(1/2)^2 + (\sqrt{3}/2)^2 = 1/4 + 3/4 = 1$ ✓

2. Now try one with the steps

A right-angled triangle has hypotenuse 12 cm and an angle of 30° . Find the side opposite 30° without a calculator.

Step 1 · $\text{opp} = \text{hyp} \times \sin 30^\circ$

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Write down the exact value of $\sin 30^\circ$. [1]

2. Write down the exact value of $\cos 60^\circ$. [1]

3. Write down the exact value of $\tan 45^\circ$. [1]

4. Write down the exact value of $\sin 90^\circ$. [1]

5. Write down the exact value of $\cos 0^\circ$. [1]

6. Write down the exact value of $\sin 60^\circ$. [1]

7. Write down the exact value of $\cos 45^\circ$. [1]

8. Write down the exact value of $\tan 60^\circ$. [1]

9. A right-angled triangle has hypotenuse 20 cm and an angle of 30° . Find the side opposite the 30° angle, in cm. [2]

10. A right-angled triangle has hypotenuse 14 cm and an angle of 60° . Find the side adjacent to the 60° angle, in cm. [2]

11. θ is acute and $\sin \theta = 1/2$. Find θ . [1]

12. θ is acute and $\tan \theta = 1$. Find θ . [1]

13. A right-angled triangle has hypotenuse 6 cm and an angle of 45° . Find the exact length of the side opposite 45° . [2]

14. Work out $\sin 30^\circ + \cos 60^\circ$. [1]

15. Work out $2 \sin 60^\circ \times \cos 30^\circ$. Give your answer fraction. [2]

4. Before you hand it in

 $\sin 30^\circ = 1/2$ because 30 is a third of 90

Sine is a ratio of sides, not of angles. From the half-equilateral triangle, $\sin 30^\circ = 1/2$.

 $\sin 60^\circ = \sqrt{3}/2$

$\sin 60^\circ = \sqrt{3}/2$ and $\cos 60^\circ = 1/2$. Sketch the triangle: the side opposite 60° is the longer leg, $\sqrt{3}$.

 $\tan 90^\circ$ is undefined

At 90° the adjacent side is 0, so $\tan 90^\circ = \text{opp} \div 0$, which is undefined.

Calculator gives $\sin 30 = 0.5$

Make sure the calculator shows D (degrees). $\sin 30^\circ$ should be exactly 0.5.