

Exact Trig Values

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (4 marks)

Write down the exact value of

(a) $\cos 30^\circ$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

(It is the same as $\sin 60^\circ$.)

Answer: $\frac{\sqrt{3}}{2}$

Tip: Do not mix up $\cos 30^\circ = \frac{\sqrt{3}}{2}$ and $\cos 60^\circ = \frac{1}{2}$. Picture the cos row of the table going down from 1 at 0° .

(b) $\tan 30^\circ$

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

This can also be written as $\frac{\sqrt{3}}{3}$.

Answer: $\frac{1}{\sqrt{3}}$ or $\frac{\sqrt{3}}{3}$

(c) $\sin 90^\circ$

$$\sin 90^\circ = 1$$

Answer: 1

(d) $\tan 45^\circ$

A right-angled triangle with a 45° angle has opposite = adjacent.

So $\tan 45^\circ = 1$

Answer: 1

2 (3 marks)

Complete the table of exact values.

A pattern to help you remember the sin row:

$$\frac{\sqrt{0}}{2}, \frac{\sqrt{1}}{2}, \frac{\sqrt{2}}{2}, \frac{\sqrt{3}}{2}, \frac{\sqrt{4}}{2}$$

These simplify to 0, $\frac{1}{2}$, $\frac{\sqrt{2}}{2}$, $\frac{\sqrt{3}}{2}$, 1

The cos row is the same values in reverse order.

$\tan = \sin \div \cos$, which gives 0, $\frac{1}{\sqrt{3}}$, 1, $\sqrt{3}$

($\frac{1}{\sqrt{3}}$ can also be written as $\frac{\sqrt{3}}{3}$.) Here is the completed table:

	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	undefined

Answer: See the completed table above

Marks: 3 marks for all 9 correct. 2 marks for 6 to 8 correct. 1 mark for 3 to 5 correct.

3 (2 marks)

ABC is a right-angled triangle.

$AC = 18$ cm and angle $BAC = 30^\circ$

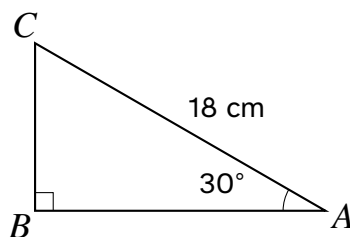


Diagram **NOT** accurately drawn

Work out the length of BC .

From the 30° angle at A : BC is the opposite and $AC = 18$ cm is the hypotenuse.

$$\text{SOH: } \sin 30^\circ = \frac{BC}{18}$$

$$BC = 18 \times \sin 30^\circ$$

$$\sin 30^\circ = \frac{1}{2}, \text{ so } BC = 18 \times \frac{1}{2} = 9$$

Answer: 9 cm

Tip: Learn $\sin 30^\circ = \frac{1}{2}$. Without it you cannot finish this question on the non-calculator paper.

Marks: 1 mark for $18 \sin 30$. 1 mark for 9.

4 (2 marks)

Here is a right-angled triangle.

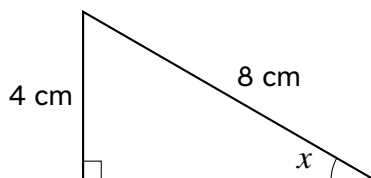


Diagram **NOT** accurately drawn

Work out the size of angle x .

From the angle x : 4 cm is the opposite and 8 cm is the hypotenuse.

$$\text{SOH: } \sin x = \frac{4}{8} = \frac{1}{2}$$

$$\sin 30^\circ = \frac{1}{2}, \text{ so } x = 30^\circ$$

Answer: 30°

Marks: 1 mark for $\sin x = \frac{4}{8}$. 1 mark for 30.

5 (2 marks)

PQR is a right-angled triangle.

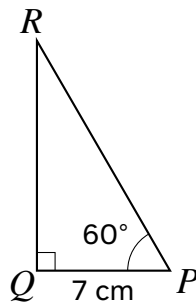


Diagram **NOT** accurately drawn

Work out the length of PR .

From the 60° angle at P : $PQ = 7$ cm is the adjacent and PR is the hypotenuse.

$$\text{CAH: } \cos 60^\circ = \frac{7}{PR}$$

$$\cos 60^\circ = \frac{1}{2}, \text{ so } 7 \text{ is half of } PR.$$

$$PR = 7 \times 2 = 14$$

Answer: 14 cm

Marks: 1 mark for $\cos 60 = \frac{7}{PR}$. 1 mark for 14.

6 (2 marks)

Here is a right-angled triangle.

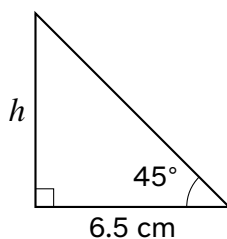


Diagram **NOT** accurately drawn

Work out the length of h .

From the 45° angle: h is the opposite and 6.5 cm is the adjacent.

$$\text{TOA: } \tan 45^\circ = \frac{h}{6.5}$$

$$h = 6.5 \times \tan 45^\circ$$

$$\tan 45^\circ = 1, \text{ so } h = 6.5 \times 1 = 6.5$$

Answer: 6.5 cm

Tip: A right-angled triangle with a 45° angle is isosceles, so the two shorter sides are equal.

Marks: 1 mark for $6.5 \tan 45$ (or $\tan 45 = \frac{h}{6.5}$). 1 mark for 6.5.

7 (2 marks)

A ladder of length 6 m leans against a vertical wall.

The foot of the ladder is on horizontal ground.

The ladder makes an angle of 60° with the ground.

Work out the distance from the foot of the ladder to the wall.

Sketch a right-angled triangle: the ladder is the hypotenuse, 6 m.

The distance along the ground is the adjacent side to the 60° angle.

$$\text{CAH: } \cos 60^\circ = \frac{d}{6}$$

$$d = 6 \times \cos 60^\circ = 6 \times \frac{1}{2} = 3$$

Answer: 3 m

Tip: Draw a sketch and label the ladder as the hypotenuse. The ground is next to the 60° angle, so use cos, not sin.

Marks: 1 mark for $6 \times \cos 60$ or equivalent. 1 mark for 3.

8 (2 marks)

Show that $4 \cos 60^\circ + 3 \tan 45^\circ = 5 \sin 90^\circ$

$$\cos 60^\circ = \frac{1}{2}, \tan 45^\circ = 1 \text{ and } \sin 90^\circ = 1$$

$$\text{Left-hand side: } 4 \times \frac{1}{2} + 3 \times 1 = 2 + 3 = 5$$

$$\text{Right-hand side: } 5 \times 1 = 5$$

Both sides equal 5, so $4 \cos 60^\circ + 3 \tan 45^\circ = 5 \sin 90^\circ$

Answer: Both sides equal 5

Tip: $4 \cos 60^\circ$ means $4 \times \cos 60^\circ$. Do not mix up $\cos 60^\circ = \frac{1}{2}$ with $\cos 30^\circ = \frac{\sqrt{3}}{2}$.

Marks: 1 mark for all three values. 1 mark for showing both sides equal 5.

9 (2 marks)

Work out the value of $\sin 30^\circ + \cos 60^\circ + \tan 45^\circ$

$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 60^\circ = \frac{1}{2}$$

$$\tan 45^\circ = 1$$

$$\frac{1}{2} + \frac{1}{2} + 1 = 2$$

Answer: 2

Marks: 1 mark for two correct values. 1 mark for 2.
