



eClassroom

GCSE MATHEMATICS • GEOMETRY

Trigonometry

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Free Trigonometry worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: use sin, cos and tan to find a side or an angle in a right-angled triangle • know the exact values of sin, cos and tan for 0° , 30° , 45° , 60° and 90° • solve problems with angles of elevation and depression • *Higher:* the sine rule, the cosine rule, $\frac{1}{2}ab \sin C$ and 3D problems.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER Higher only: the sine rule, the cosine rule, area $= \frac{1}{2}ab \sin C$ and trigonometry in 3D. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	15
Higher marks	16	14	17	15
My score				

Full worked solutions

Geometry revision engine

Free courses

Formula sheet builder

Name

Class

Date



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

A

Worked examples & Your turn

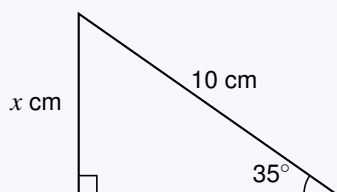
Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION

Everyone starts here

Worked example A1

Work out the value of x , to 1 decimal place.

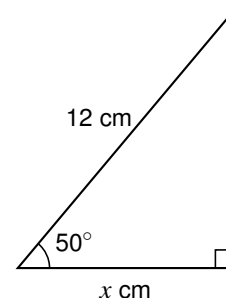


x is opposite 35° and 10 is the hypotenuse, so use $\sin$:
 $x = 10 \sin 35^\circ$

$$x = 5.7$$

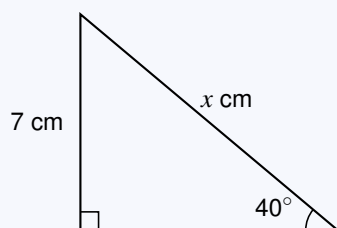
Your turn A1

Work out the value of x , to 1 decimal place.



Worked example A2

Work out the value of x , to 1 decimal place.



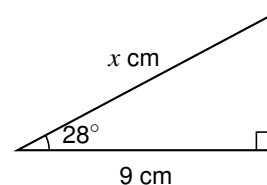
7 is opposite 40° and x is the hypotenuse: $\sin 40^\circ = \frac{7}{x}$,

$$\text{so } x = \frac{7}{\sin 40^\circ}$$

$$x = 10.9$$

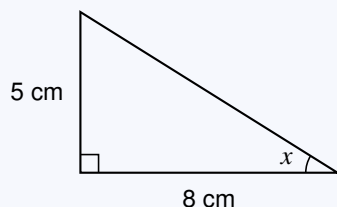
Your turn A2

Work out the value of x , to 1 decimal place.



Worked example A3

Work out the value of x , to 1 decimal place.

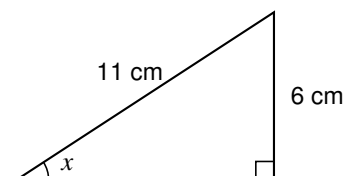


Opposite 5, adjacent 8: $\tan x = \frac{5}{8}$, so $x = \tan^{-1}\left(\frac{5}{8}\right)$

$$x = 32.0$$

Your turn A3

Work out the value of x , to 1 decimal place.

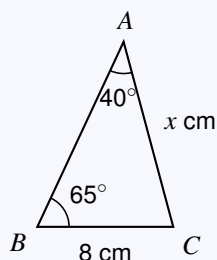


HIGHER*Higher only: the sine rule, the cosine rule and area***Worked example A4: the sine rule**

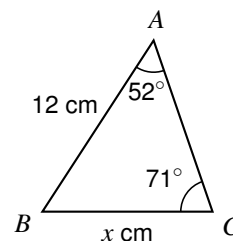
Work out the value of x , to 1 decimal place.

$$\frac{x}{\sin 65^\circ} = \frac{8}{\sin 40^\circ}$$

$$x = 11.3$$

**Your turn A4**

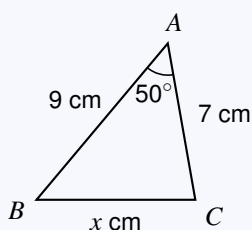
Work out the value of x , to 1 decimal place.

**Worked example A5: the cosine rule for a side**

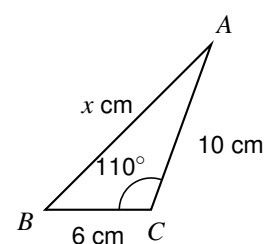
Work out the value of x , to 1 decimal place.

$$x^2 = 7^2 + 9^2 - 2(7)(9) \cos 50^\circ$$

$$x = 7.0$$

**Your turn A5**

Work out the value of x , to 1 decimal place.

**Worked example A6: the cosine rule for an angle**

A triangle has sides 5, 7 and 9 cm. Work out its largest angle, to 1 d.p.

$$\text{Opposite } 9 \text{ cm: } \cos \theta = \frac{5^2 + 7^2 - 9^2}{2 \times 5 \times 7} = -0.1$$

$$95.7^\circ$$

Your turn A6

A triangle has sides 6, 8 and 11 cm. Work out its largest angle, to 1 d.p.

Worked example A7: area = $\frac{1}{2}ab \sin C$

$AB = 8$ cm, $AC = 11$ cm and angle $BAC = 40^\circ$. Work out the area of triangle ABC , to 1 d.p.

$$\frac{1}{2} \times 8 \times 11 \times \sin 40^\circ$$

$$28.3 \text{ cm}^2$$

Your turn A7

$PQ = 9$ cm, $PR = 14$ cm and angle $QPR = 125^\circ$. Work out the area of triangle PQR , to 1 d.p.

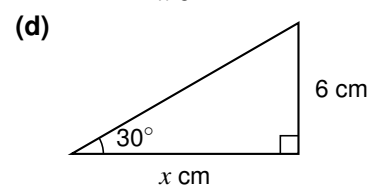
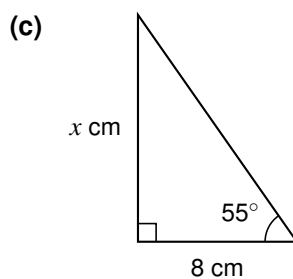
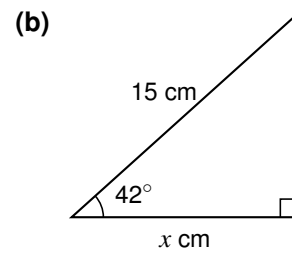
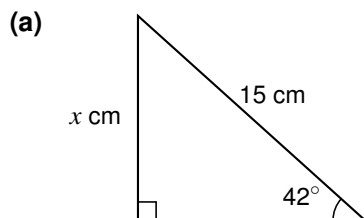


B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

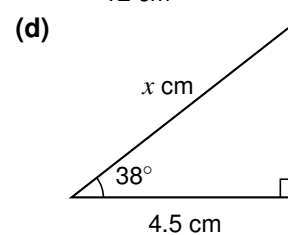
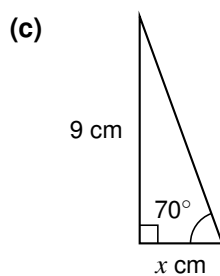
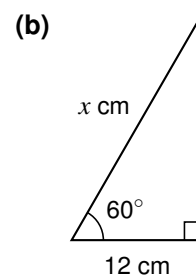
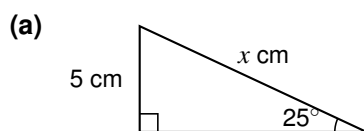
FOUNDATION*Everyone starts here*

B1 Work out the value of x in each triangle. Give each answer to 1 decimal place.



[4 marks]

B2 Work out the value of x in each triangle. Give each answer to 1 decimal place.



[4 marks]



FOUNDATION *continued: angles, exact values and problems*

B3 Triangle ABC has a right angle at B . Work out angle ACB , to 1 decimal place, when

(a) $AB = 4$ cm and $BC = 7$ cm

(b) $AB = 4$ cm and $AC = 7$ cm

(c) $BC = 4$ cm and $AC = 7$ cm

(d) $AB = 7$ cm and $BC = 4$ cm

[4 marks]

B4 Do not use a calculator.

(a) Write down the exact value of $\sin 30^\circ$

(b) Write down the exact value of $\cos 45^\circ$

(c) Write down the exact value of $\tan 60^\circ$

(d) A right-angled triangle has a hypotenuse of 10 cm and an angle of 30° . Work out the side opposite the 30° angle.

[4 marks]

B5 Give each answer to 1 decimal place.

(a) A tree is 12 m tall. Ali stands 20 m from its base on level ground. Work out the angle of elevation of the top of the tree.

(b) From the top of a cliff 50 m high, the angle of depression of a boat is 24° . How far is the boat from the foot of the cliff?

(c) A kite string is 30 m long and makes an angle of 55° with the ground. How high is the kite? [3 marks]

B6 The diagram shows an isosceles triangle.

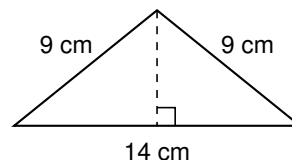
(a) Work out the size of a base angle.

(b) Work out the size of the top angle.

(c) Work out the height.

(d) Work out the area.

Give each answer to 1 decimal place.



[4 marks]

HIGHER *Higher tier only*

B7 In triangle ABC , give each answer to 1 decimal place.

(a) $A = 35^\circ$, $B = 70^\circ$, $a = 6$ cm. Find b .

(b) $A = 48^\circ$, $C = 62^\circ$, $a = 10$ cm. Find c .

(c) $a = 9$ cm, $b = 12$ cm, $A = 40^\circ$, and B is acute. Find B .

(d) $a = 15$ cm, $c = 11$ cm, $A = 100^\circ$. Find C .

[4 marks]



HIGHER*continued: the cosine rule, area and 3D*

B8 In triangle ABC , give each answer to 1 decimal place where it is not exact.

(a) $b = 5$ cm, $c = 8$ cm, $A = 60^\circ$. Find a .

(b) $a = 10$ cm, $b = 12$ cm, $C = 35^\circ$. Find c .

(c) $a = 7$, $b = 8$, $c = 13$. Find the largest angle.

(d) $a = 4$, $b = 6$, $c = 7$. Find the smallest angle.

[4 marks]

B9 (a) Work out the area of a triangle with sides 7 cm and 9 cm and an included angle of 50°

(b) A triangle has area 40 cm². Two sides are 10 cm and x cm, with an included angle of 30° . Find x .

(c) A triangle has area 20 cm² and two sides of 8 cm and 6 cm. Find the acute angle between these sides.

(d) Work out the exact area of an equilateral triangle with sides of 6 cm.

[4 marks]

B10 The diagram shows a cuboid.

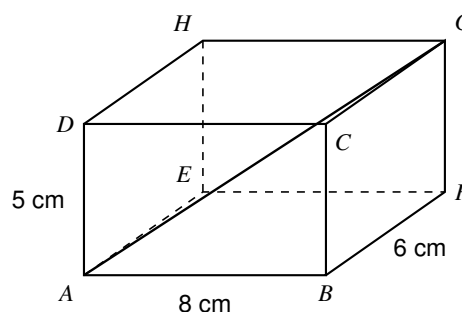
(a) Work out AF

(b) Work out AG , to 1 d.p.

(c) Work out the angle between AG and the base $ABFE$

(d) Work out angle GAB

Give angles to 1 decimal place.



[4 marks]



C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** In a right-angled triangle, the side next to a 40° angle is 8 cm and x is the side opposite it. Tom writes $x = 8 \sin 40^\circ$
Explain Tom's mistake, and find x to 1 decimal place. [2 marks]
- C2** Sam types $\sin 30$ into his calculator and gets -0.988
Explain what has gone wrong, and give the correct value. [2 marks]
- C3** Explain why $\sin x$ can never be greater than 1 for an angle x in a right-angled triangle. [3 marks]
- C4** Use a right-angled isosceles triangle to show that $\tan 45^\circ = 1$ and that $\sin 45^\circ = \frac{1}{\sqrt{2}}$ [3 marks]



HIGHER*Higher tier only*

- C5** Kai uses the cosine rule with $b = 5$, $c = 6$ and $A = 70^\circ$. He works out $(5^2 + 6^2 - 2 \times 5 \times 6) \cos 70^\circ$
Explain Kai's mistake, and find a to 1 decimal place. [3 marks]
- C6** You know the three sides of a triangle but none of its angles. Explain why you cannot start with the sine rule, and say which rule you would use. [3 marks]
- C7** Show that the area of an equilateral triangle with side a is $\frac{\sqrt{3}}{4}a^2$ [3 marks]
- C8** In triangle ABC , $AB = 10$ cm, $BC = 7$ cm and angle $BAC = 35^\circ$
(a) Show that there are two possible values for angle ACB , and find both, to 1 decimal place.
(b) Explain why the sine rule gives two answers here. [5 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** A wheelchair ramp must not slope at more than 5° to the horizontal. A ramp rises 0.5 m over a horizontal distance of 5.5 m.

Is the ramp allowed? You must show your working.

[3 marks]

- D2** The diagram shows an isosceles trapezium.

Work out its area, to 1 decimal place.

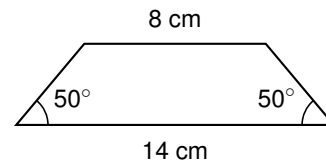


Diagram NOT accurately drawn

[4 marks]

- D3** A plane takes off and climbs in a straight line at 12° to the ground. It flies 3 km along this line.

How high is the plane? Give your answer in metres, to the nearest metre.

[3 marks]

- D4** Do not use a calculator.

A right-angled triangle has a hypotenuse of 8 cm and an angle of 60° . Work out the exact lengths of the other two sides.

[3 marks]



HIGHER

Higher tier only

- D5** A ship sails 12 km on a bearing of 050° , then 8 km on a bearing of 130° .
How far is the ship from its starting point? Give your answer to 1 decimal place.

[4 marks]

- D6** In triangle ABC , $AB = 10$ cm, angle $BAC = 50^\circ$ and angle $ABC = 60^\circ$.
Work out the area of the triangle, to 1 decimal place.

[4 marks]

- D7** $VABCD$ is a pyramid with a square base of side 6 cm. V is vertically above M , the centre of the base, and $VM = 8$ cm.
Work out the angle between a sloping edge and the base, to 1 decimal place.

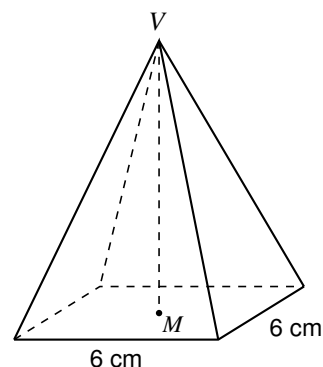


Diagram NOT accurately drawn

[4 marks]

- D8** (a) Use the cosine rule to show that $x^2 + 3x - 40 = 0$
(b) Find x , and hence the exact area of the triangle.

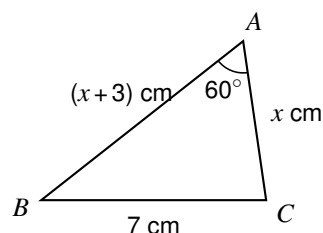


Diagram NOT accurately drawn

[5 marks]

E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION *Foundation and Higher crossover*

E1 Work out the value of x , to 1 decimal place.

.....

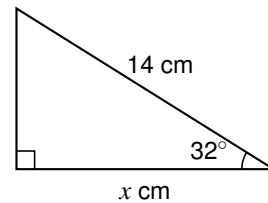


Diagram NOT accurately drawn

(Total for Question E1 is 2 marks)

E2 Work out the value of x , to 1 decimal place.

.....

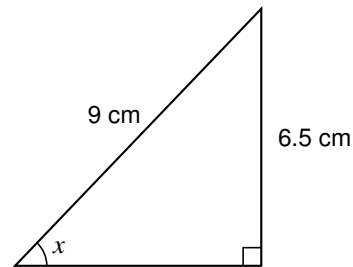


Diagram NOT accurately drawn

(Total for Question E2 is 3 marks)

E3 Work out the value of x , to 1 decimal place.

.....

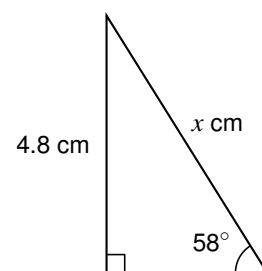


Diagram NOT accurately drawn

(Total for Question E3 is 3 marks)



E4 Do not use a calculator.

(a) Write down the exact value of $\tan 45^\circ$

.....
(1)

(b) Write down the exact value of $\sin 60^\circ$

.....
(1)

(Total for Question E4 is 2 marks)

E5 Mia stands 25 m from the foot of a flagpole on level ground. The angle of elevation of the top of the flagpole is 28° .

Work out the height, h m, of the flagpole, to 1 decimal place.

.....

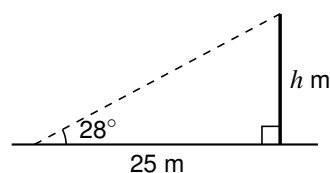


Diagram NOT accurately drawn

(Total for Question E5 is 3 marks)

E6 Do not use a calculator.

Use exact values to show that $\tan 30^\circ \times \tan 60^\circ = 1$

(Total for Question E6 is 2 marks)

HIGHER

Higher tier only

E7 Work out the value of x , to 1 decimal place.

.....

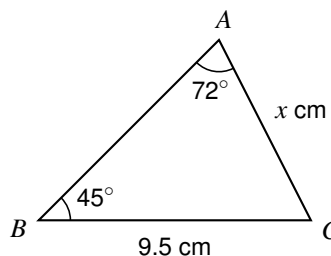


Diagram NOT accurately drawn

(Total for Question E7 is 3 marks)



E8 Work out the value of x , to 1 decimal place.

.....

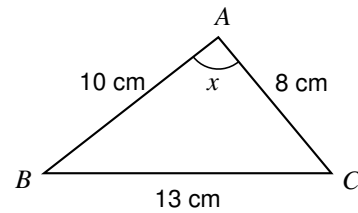


Diagram NOT accurately drawn

(Total for Question E8 is 3 marks)

E9 (a) Work out the area of triangle ABC , to 1 decimal place.

.....
(2)

(b) Work out the length of BC , to 1 decimal place.

.....
(2)

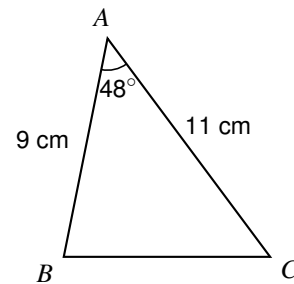


Diagram NOT accurately drawn

(Total for Question E9 is 4 marks)

E10 $ABCD$ is a quadrilateral.
Work out the length of AD , to 1 decimal place.

.....

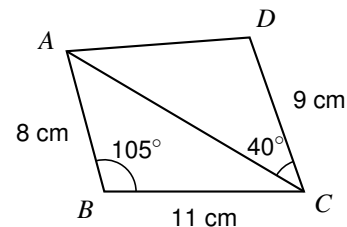


Diagram NOT accurately drawn

(Total for Question E10 is 5 marks)

Finished? Mark your work with the **full worked solutions**, fill in your scores on the front page, then keep the skill sharp with unlimited questions on the **Geometry revision engine**.



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk