HIGHER

# 7.13 The Cosine Rule: 30-minute Pack

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

## The Cosine Rule: Fluency and Exam Drill

*Revision Library original resource, written for Edexcel 1MA1 (Higher tier)*

The cosine rule connects the three sides of a triangle with one of its angles. For a triangle with sides a, b and c, and angle A opposite side a:

a^2 = b^2 + c^2 - 2*b*c*cos(A)

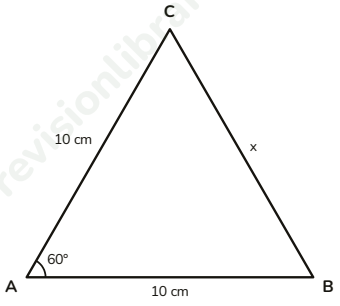
Rearranged to find an angle when all three sides are known:

cos(A) = (b^2 + c^2 - a^2) / (2*b*c)

Use the cosine rule whenever you know two sides and the included angle (to find the third side), or all three sides (to find any angle). A calculator is allowed and expected throughout; give lengths correct to 3 significant figures and angles correct to 1 decimal place unless told otherwise. Questions 1 to 14 build fluency with the rule in both directions. Questions 15 to 20 apply it to exam-style problems, including bearings, perimeters, a combined area calculation, a two-triangle quadrilateral problem and an algebraic setup. The final two questions are grade 9 stretch problems requiring an exact surd answer and multi-step reasoning.

**1** Triangle ABC has AB = 10 cm, AC = 10 cm and angle BAC = 60 degrees. Calculate the length of BC, then state (with a reason) what type of triangle ABC is.

Diagram NOT accurately drawn

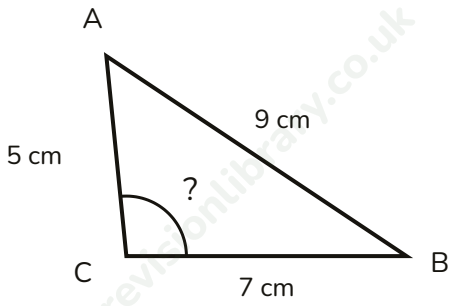



**(Total for Question 1 is 3 marks)**


© Revision Library | revisionlibrary.co.uk

**2** In triangle ABC, AB = 9 cm, BC = 7 cm and CA = 5 cm. Calculate the size of angle C. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

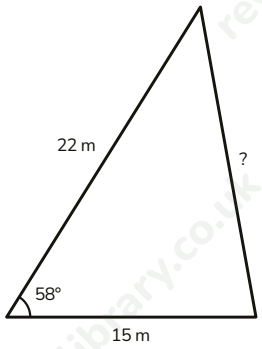



**(Total for Question 2 is 3 marks)**


© Revision Library | revisionlibrary.co.uk

**3** A triangular garden plot has two sides of length 15 m and 22 m, with an angle of 58 degrees between them.

Diagram NOT accurately drawn




**(a)** Calculate the length of the third side of the plot. Give your answer correct to 3 significant figures. **(3)**

.....

**(b)** A fence is to be built along this third side, costing £8.50 per metre. Using your unrounded answer to part (a), work out the total cost of the fence. Give your answer to the nearest penny. **(2)**

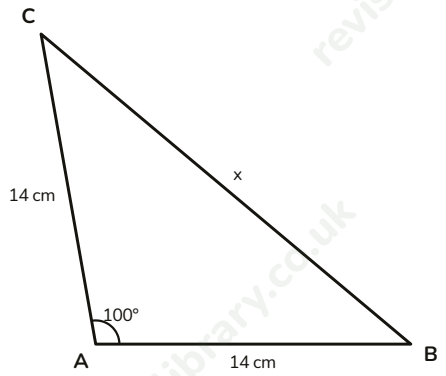
.....

**(Total for Question 3 is 5 marks)**


© Revision Library | revisionlibrary.co.uk

**4** Triangle ABC is isosceles with AB = AC = 14 cm and angle BAC = 100 degrees. Work out the length of BC. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

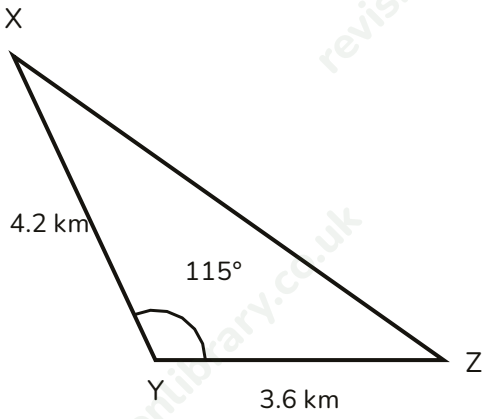



**(Total for Question 4 is 2 marks)**


© Revision Library | revisionlibrary.co.uk

**5** A yacht race course is a triangle with buoys X, Y and Z, where XY = 4.2 km, YZ = 3.6 km and angle XYZ = 115 degrees.

Diagram NOT accurately drawn




**(a)** Calculate the length XZ. Give your answer correct to 3 significant figures. **(3)**

.....

**(b)** The race requires sailing around the course (X to Y to Z to X) twice. Using your unrounded answer to part (a), work out the total distance sailed. Give your answer correct to 3 significant figures. **(2)**

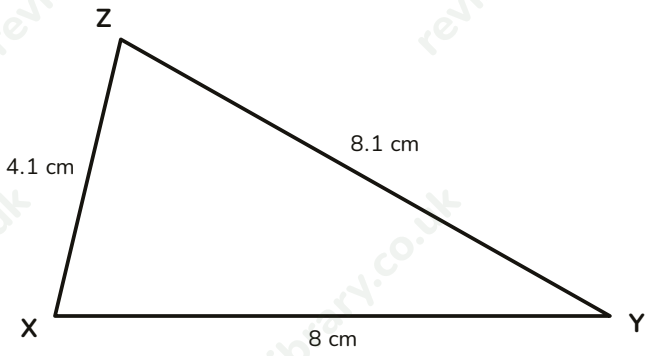
.....

**(Total for Question 5 is 5 marks)**


© Revision Library | revisionlibrary.co.uk

**6** In triangle XYZ, YZ = 8.1 cm, XZ = 4.1 cm and XY = 8 cm. Work out the size of angle YXZ. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

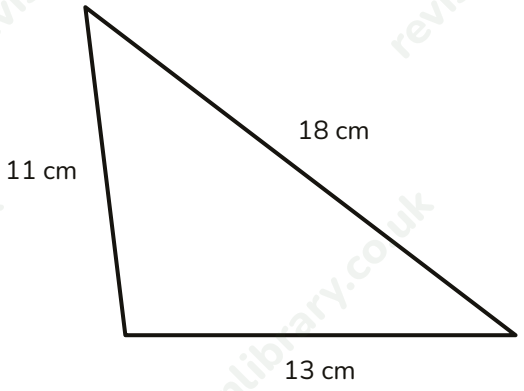



**(Total for Question 6 is 3 marks)**

---

**7** A triangle has sides of length 11 cm, 13 cm and 18 cm. Show that the triangle is obtuse-angled.

Diagram NOT accurately drawn




**(Total for Question 7 is 3 marks)**


© Revision Library | revisionlibrary.co.uk

# Mark scheme · 7.13 The Cosine Rule: 30-minute Pack

## Question 1

| | |
|---|---|
| correct substitution, e.g. $BC^2 = 10^2 + 10^2 - 2*10*10*\cos(60)$ oe | **M1** |
| BC = 10 cm, cao | **A1** |
| equilateral (ft their BC), since AB = AC = BC = 10 cm (all three sides equal) | **B1** |

**Answer: BC = 10 cm; triangle ABC is equilateral (all three sides equal 10 cm)**

## Question 2

| | |
|---|---|
| $\cos C = (7^2 + 5^2 - 9^2) / (2 \times 7 \times 5)$ oe | **M1** |
| cosC = -0.1 awrt (dep) | **M1** |
| 95.7 degrees awrt | **A1** |

**Answer: 95.7 degrees (1 dp)**

## Question 3

| | |
|---|---|
| (a) $x^2 = 15^2 + 22^2 - 2 \times 15 \times 22 \times \cos 58$ oe | **M1** |
| (a) $x^2 = 359$ awrt (dep) | **M1** |
| (a) 19.0 m awrt | **A1** |

**(a) Answer: 19.0 m (3 sf)**

| | |
|---|---|
| (b) their unrounded length x 8.50 ft | **M1** |
| (b) £161.11 cao using the unrounded length. Accept £161.08 from 18.95 m or £161.50 from 19.0 m only with the corresponding correctly rounded intermediate length shown; accept other values only when supported by correct rounding of intermediate steps. Do not accept a continuous range. | **A1** |

**(b) Answer: £161.11**

## Question 4

| | |
|---|---|
| correct substitution, e.g. $BC^2 = 14^2 + 14^2 - 2*14*14*\cos(100)$ oe | **M1** |
| BC = 21.4 cm (awrt 21.4), cao | **A1** |

**Answer: BC = 21.4 cm (3 s.f.)**

## Question 5

| | |
|---|---|
| (a) $XZ^2 = 4.2^2 + 3.6^2 - 2 \times 4.2 \times 3.6 \times \cos 115$ oe | **M1** |
| (a) $XZ^2 = 43.4$ awrt (dep) | **M1** |
| (a) 6.59 km awrt | **A1** |

**(a) Answer: 6.59 km (3 sf)**

| | |
|---|---|
| (b) 2 x (4.2 + 3.6 + their XZ) ft | **M1** |
| (b) 28.8 km awrt (ft their XZ) | **A1** |

**(b) Answer: 28.8 km (3 sf)**

## Question 6

| | |
|---|---|
| $\cos A = (b^2 + c^2 - a^2)/(2bc)$ with correct values | **M1** |
| cos A = 0.2317 or equivalent | **M1** |
| 76.6 degrees cao | **A1** |

**Answer: 76.6 degrees**

## Question 7

| | |
|---|---|
| considers the angle opposite the longest side (18 cm) using $\cos C = (11^2+13^2-18^2)/(2x11x13)$ oe | **M1** |
| cosC = -34/286 = -0.119 awrt (or compares $18^2$=324 with $11^2+13^2$=290) | **A1** |
| since cosC is negative (or 324 > 290), the angle opposite the 18 cm side is obtuse, so the triangle is obtuse-angled cso | **A1** |

**Answer: Obtuse-angled (angle opposite 18 cm is approximately 96.8 degrees)**


© Revision Library | revisionlibrary.co.uk