Name	Date started	Target end date

GCE AS / A LEVEL — PURE MATHEMATICS A QUESTION PACK

0974-01 (Legacy C2) · New spec Unit 1 Topic 9 · AS unit, 25% of A-level, 120 marks, 2h 30min paper

REVISE
.wales

MATHEMATICS — PURE A · SINE & COSINE RULES / TRIANGLES

Sine & Cosine Rules / Triangles

Sine rule, cosine rule and triangle-area questions from the legacy WJEC C2 papers (June 2011 - June 2017)

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~1 hour 19 minutes

*Derived from the legacy C1/C2 paper's pace of **~1.25 min/mark** (63 marks over 9 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains questions from the legacy WJEC C1 and C2 papers (2008 modular spec) that maps onto new-spec AS Unit 1 Topic 9 (2.1.9).

Questions are ordered chronologically.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

A calculator is allowed (except where specified by individual questions). The WJEC Formula Booklet may be referred to.

For Examiner's use only

Q	Source	Max	Mark
1	Jan 12 Q3	8	
2	Jun 12 Q3	7	
3	Jan 13 Q3	6	
4	Jun 13 Q3	7	
5	Jan 14 Q5	9	

Q	Source	Max	Mark
6	Jun 14 Q3	6	
7	Jun 15 Q3	6	
8	Jun 16 Q3	8	
9	Jun 17 Q3	6	
Total		**63**	

Sine & Cosine Rules / Triangles — what the new spec asks

WJEC GCE AS / A Level Mathematics (from 2017) · Unit 1: Pure Mathematics A · Topic 2.1.5.

Sine rule 2.1.5

- $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.
- Use when given two angles + a side, or two sides + a non-included angle.
- Beware the ambiguous case: $\sin$ can return two angles in $[0, 180^\circ]$.

Cosine rule 2.1.5

- $a^2 = b^2 + c^2 - 2bc\cos A$ — find side opposite to known angle.
- $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ — find angle from three sides.
- Use when given three sides, or two sides + included angle.

Area of triangle 2.1.5

- $\text{Area} = \frac{1}{2}ab\sin C$ — two sides + included angle.
- Pick any pair of sides with the included angle between them.
- Useful for problems where area is given and an unknown side is sought.

Multi-triangle problems 2.1.5

- Split a complex shape into two triangles sharing a side or angle.
- Apply cosine rule in each triangle, then eliminate the shared length / angle.
- Useful when a cevian (e.g. AD inside triangle ABC) divides the figure.

Crib sheet »

Sine & Cosine Rules in one page

Quick-reference notes — revisit before each section. Don't use during questions.

Sine rule

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

Use when given (two angles + a side) or (two sides + a non-included angle).

Cosine rule (find a side)

$a^2 = b^2 + c^2 - 2bc\cos A$.

Use when given two sides + the included angle.

Cosine rule (find an angle)

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$.

Use when given all three sides.

$\arccos$ returns a unique angle in $[0, 180^\circ]$.

Triangle area

$\text{Area} = \frac{1}{2}ab\sin C$.

Choose any two sides with the included angle between them.

Equivalent for the other pairs of sides / angles.

Ambiguous case

Using sine rule with two sides + non-included angle: $\sin X$ may correspond to two angles.

$X_1 = \arcsin(\ldots)$ and $X_2 = 180^\circ - X_1$.

Both may be geometrically valid — check using the angle sum.

Triangle with a cevian

Cevian: line from a vertex to the opposite side (e.g. AD in $\triangle ABC$).

Apply cosine rule in both sub-triangles (ABD and ACD) sharing the cevian.

Set the two expressions equal to eliminate / find the unknown.

Bearings & navigation

Bearings: measured clockwise from north.

Set up a triangle with given bearings as interior angles (or supplements).

Apply sine or cosine rule as appropriate.

Mixed-rule problems

If you have two sides + the angle between, start with cosine rule.

If you have three sides, use cosine rule for an angle.

If you have a side and its opposite angle, prefer sine rule.

Strategy

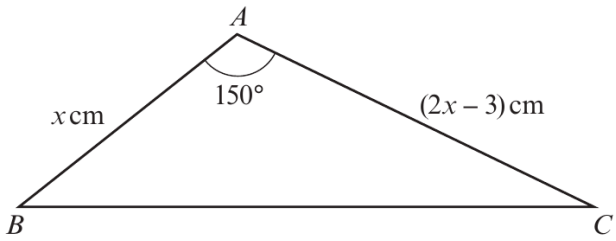
1. Draw a clear diagram, label sides + angles.
2. Identify which rule fits the given data.
3. Substitute and solve.
4. Check by computing the third angle / side.

SECTION T9

Sine & Cosine Rules / Triangles

Questions 1–9 · 63 marks

3. The diagram below shows a sketch of the triangle ABC with $AB = x$ cm, $AC = (2x - 3)$ cm and $B\hat{A}C = 150°$. The area of triangle ABC is $6{\cdot}75\,\text{cm}^2$.



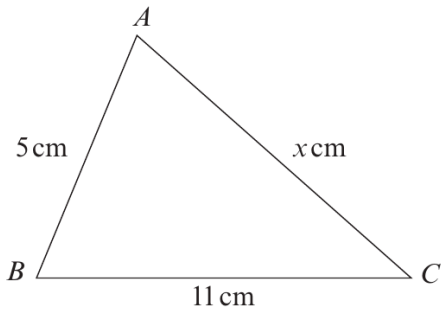
(a) Show that x satisfies the equation $2x^2 - 3x - 27 = 0$. Hence evaluate x. [4]

(b) Find the length of BC. Give your answer correct to two decimal places. [2]

The point D lies on BC and is such that AD is perpendicular to BC.

(c) Find the length of AD. Give your answer correct to two decimal places. [2]

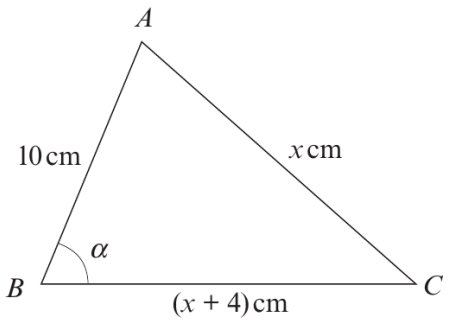
3. *(a)* The diagram below shows a sketch of the triangle ABC with $AB = 5\,\text{cm}$, $AC = x\,\text{cm}$, $BC = 11\,\text{cm}$ and $\cos B\hat{A}C = \frac{2}{5}$.



Write down and simplify a quadratic equation satisfied by x.
Hence evaluate x. [3]

(b) The triangle XYZ is such that $XY = 32\,\text{cm}$, $XZ = 15\,\text{cm}$ and $X\hat{Y}Z = 19°$.
Find the possible values of $Y\hat{X}Z$. Give your answers correct to the nearest degree. [4]

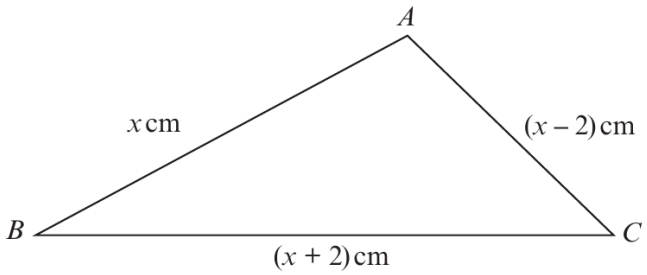
3. The diagram below shows a sketch of the triangle ABC with $AB = 10\,\text{cm}$, $AC = x\,\text{cm}$, $BC = (x + 4)\,\text{cm}$ and $A\hat{B}C = \alpha$, where $\cos\alpha = \frac{3}{5}$.



(a) Write down and simplify an equation satisfied by x. Hence, evaluate x. [3]

(b) Find the exact value of the area of triangle ABC. [3]

3. The diagram below shows a sketch of the triangle ABC with $AB = x$ cm, $AC = (x - 2)$ cm and $BC = (x + 2)$ cm.



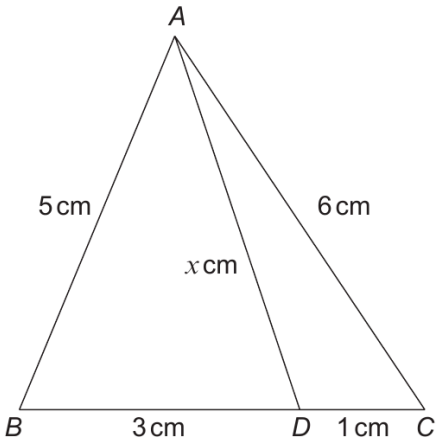
(a) Show that $\cos B\hat{A}C = \dfrac{x-8}{2x-4}$. [3]

(b) Given that $B\hat{A}C = 120^{\circ}$,

(i) find the value of x,

(ii) find the size of $A\hat{B}C$. [4]

5. The diagram below shows a sketch of the triangle ABC with $AB = 5$ cm and $AC = 6$ cm. The point D is on BC such that $BD = 3$ cm, $DC = 1$ cm and $AD = x$ cm.

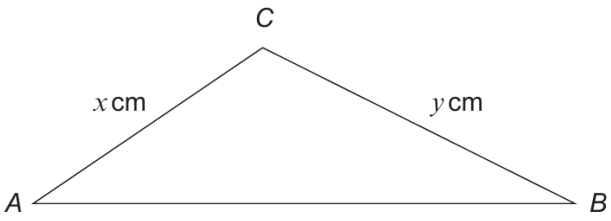


(a) (i) By applying the cosine rule in each of the triangles ADB and ADC, show that $\cos A\hat{D}B = \dfrac{x^2 - 16}{6x}$ and find a similar expression for $\cos A\hat{D}C$.

(ii) Noting that $A\hat{D}B$ and $A\hat{D}C$ are angles on a straight line, use the expressions derived in part (i) to write down an equation satisfied by x. Hence show that $x = 5{\cdot}5$. [6]

(b) Find the area of triangle ADB. Give your answer correct to two decimal places. [3]

3. The diagram below shows a sketch of the triangle ABC with $\sin A = \frac{4}{5}$, $\sin B = \frac{8}{17}$, $\cos C = -\frac{13}{85}$, $AC = x$ cm and $BC = y$ cm.



(a) Show that $y = 1{\cdot}7x$. [2]

(b) Given that $AB = 10{\cdot}5$ cm, **use the cosine rule** to find the exact value of x. [4]

3. The triangle ABC is such that $AB = 19\,\text{cm}$, $AC = 12\,\text{cm}$ and $A\hat{B}C = 25°$.

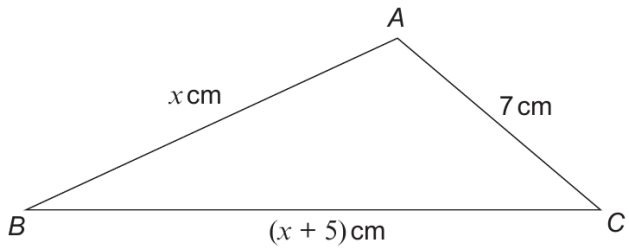
(a) Find the possible values of $A\hat{C}B$. Give your answers correct to the nearest degree. [2]

(b) Given that $B\hat{A}C$ is an **acute** angle, find

(i) the size of $B\hat{A}C$, giving your answer correct to the nearest degree,

(ii) the area of triangle ABC, giving your answer correct to two decimal places. [4]

3. The diagram below shows a sketch of the triangle ABC with $AB = x$ cm, $BC = (x + 5)$ cm, $AC = 7$ cm and $\cos B\hat{A}C = -\frac{3}{5}$.

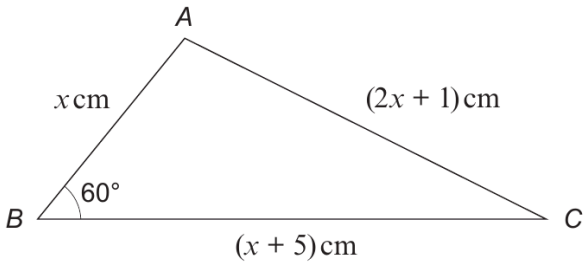


(a) Write down an equation satisfied by x. Hence show that $x = 15$. [3]

(b) Find the exact value of the area of triangle ABC. [3]

(c) The point D lies on BC and is such that AD is perpendicular to BC. Find the length of AD. [2]

3. The diagram below shows a sketch of the triangle ABC with $AB = x\,\text{cm}$, $BC = (x + 5)\,\text{cm}$, $AC = (2x + 1)\,\text{cm}$ and $A\hat{B}C = 60°$.



(a) Show that x satisfies the equation $3x^2 - x - 24 = 0$. Hence evaluate x. [4]

(b) Find the size of $A\hat{C}B$. [2]

END OF SINE & COSINE RULES / TRIANGLES PACK

Source: WJEC C1 + C2 (2008 modular spec) · 2011–2017
Curated for WJEC Maths 2017 spec AS Unit 1 — Topic 9 (2.1.9)