IB MATHS AA SL · UNIT 3

Non right angled trigonometry: exam practice

10 questions · 54 marks · worked solutions and markschemes

Name _____ Date _____ Score / 54

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slaa/non-right-angled-trigonometry-exam-practice

1. **2 marks · Paper 1 style · no calculator**

A triangle has sides of length 6 cm and 10 cm, and the angle between them is $30°$. Find its exact area.

2. **5 marks · Paper 2 style · calculator**

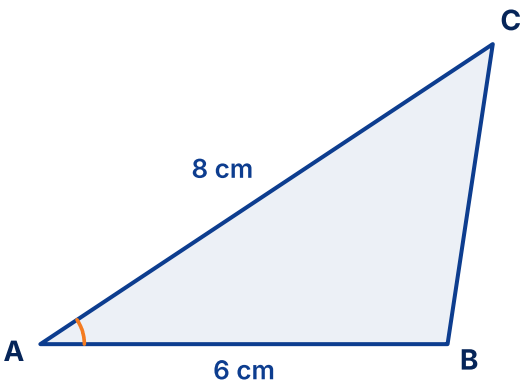
In triangle ABC, the side lengths are $AB = 9\ \text{cm}$ and $BC = 7\ \text{cm}$, and the angle $B\hat{A}C = 45°$. Find the two possible values for angle $A\hat{C}B$, giving your answers correct to one decimal place.

3. **4 marks · Paper 1 style · no calculator**

The following diagram shows triangle ABC, with $AB = 6\ \text{cm}$ and $AC = 8\ \text{cm}$.

Given that $\cos \hat{A} = \frac{5}{6}$:

1. Find the exact value of $\sin \hat{A}$.
2. Find the exact area of triangle ABC.



Triangle ABC

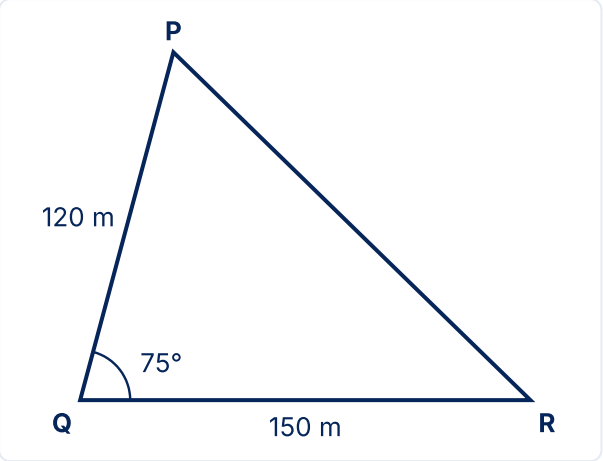
4. **5 marks · Paper 2 style · calculator**

Owen, Henry and Tom are rugby players passing a ball in a park. Owen is at point O, Henry is at point H and Tom is at point T. The distance between Owen and Henry is $25\ \text{m}$ and the distance between Henry and Tom is $18\ \text{m}$. The angle $O\hat{H}T$ is $96°$.

1. Find the distance of the pass from Owen directly to Tom, OT.
2. Find the size of the angle $O\hat{T}H$.

5. **5 marks · Paper 2 style · calculator**

A triangular park PQR is bounded by three straight paths. The length of PQ is $120\ \text{m}$, the length of QR is $150\ \text{m}$, and the angle $P\hat{Q}R$ is $75°$.



1. Calculate the length of the path PR.
2. Calculate the total area of the park.

6. **5 marks · Paper 1 style · no calculator**

A triangle has sides of length 5 cm, 7 cm and 8 cm.

(a) Show that the angle opposite the side of length 7 cm is $60°$. **[3]**

(b) Find the exact area of the triangle. **[2]**

7. **7 marks · Paper 2 style · calculator**

In triangle ABC, $AB = 7$ cm, $AC = 10$ cm and $B\hat{A}C = 48°$.

(a) Find BC. **[3]**

(b) Find the area of the triangle. **[2]**

(c) Find $A\hat{B}C$. **[2]**

8. **6 marks · Paper 2 style · calculator**

A small airline operates between three locations A, B and C. B is located $530\ \text{km}$ from A on a bearing of $248°$. C is located $300\ \text{km}$ due East from the midpoint, M, of the line segment AB.

1. Find the size of the angle $A\hat{M}C$.
2. Calculate the straight-line distance AC.

9. **7 marks · Paper 2 style · calculator**

Triangle XYZ has $XY = 6$ cm, $XZ = 9$ cm and area $20\ \text{cm}^2$.

(a) Find the two possible values of $Y\hat{X}Z$. **[4]**

(b) Find the greatest possible length of YZ. **[3]**

10. **8 marks · Paper 2 style · calculator**

A ship leaves port P and sails 12 km on a bearing of $040°$ to Q. It then sails 9 km on a bearing of $115°$ to R.

(a) Show that $P\hat{Q}R = 105°$. **[2]**

(b) Find the distance PR. **[3]**

(c) Find the bearing of R from P. **[3]**

Answers and worked solutions

Question 1

2 marks

Answer: $15\ \text{cm}^2$

$\frac{1}{2} \times 6 \times 10 \times \frac{1}{2}$ (M1)

$= 15\ \text{cm}^2$ A1

Question 2

5 marks

Answer: $65.4°, 114.6°$

Substitute into the sine rule: $\frac{\sin C}{9} = \frac{\sin 45°}{7}$ M1

$\sin C = \frac{9 \sin 45°}{7} = 0.9091\ldots$ A1

Acute solution: $C = \arcsin(0.9091\ldots) = 65.4°$ A1

Ambiguous case, obtuse solution:

$C = 180° - 65.39°$ M1

$C = 114.6°$ A1

Question 3

4 marks

Answer: (a) $\sqrt{11}/6$; (b) $4\sqrt{11}\ \text{cm}^2$

1. Use the identity $\sin^2 A + \cos^2 A = 1$:
   $\sin A = \sqrt{1 - \left(\frac{5}{6}\right)^2} = \sqrt{\frac{11}{36}}$ (positive, as A is an angle of a triangle). (M1)
   $\sin A = \frac{\sqrt{11}}{6}$. A1
2. Area
   $= \frac{1}{2}(AB)(AC)\sin A = \frac{1}{2}(6)(8)\left(\frac{\sqrt{11}}{6}\right)$. (M1)
   Area $= 24 \times \frac{\sqrt{11}}{6} = 4\sqrt{11}\ \text{cm}^2$. A1

Question 4

5 marks

Answer: (a) $32.3\ m$; (b) $50.3°$

1. Use the cosine rule:
   $OT^2 = OH^2 + HT^2 - 2(OH)(HT)\cos O\hat{H}T$.
   $OT^2 = 25^2 + 18^2 - 2(25)(18)\cos 96°$. (M1)(A1)
   $OT = \sqrt{949 - 900\cos 96°} = \sqrt{1043.07\ldots} = 32.296\ldots \approx 32.3\ \text{m}$. A1
2. Use the sine rule: $\frac{\sin O\hat{T}H}{25} = \frac{\sin 96°}{32.296\ldots}$. (M1)
   $\sin O\hat{T}H = 0.7698\ldots \implies O\hat{T}H = 50.338\ldots \approx 50.3°$. A1

Question 5

5 marks

Answer: (a) $166\ m$; (b) $8690\ m^2$

1. Substitute into the cosine rule:
   $PR^2 = 120^2 + 150^2 - 2(120)(150)\cos 75°$ M1
   $PR^2 = 36900 - 36000\cos 75° = 27582.6\ldots$ (A1)
   $PR = 166\ \text{m}$ (3 s.f.) A1
2. Substitute into $\text{Area} = \frac{1}{2}ab\sin C$:
   $\frac{1}{2}(120)(150)\sin 75°$ M1
   $\text{Area} = 8690\ \text{m}^2$ (3 s.f.) A1

Question 6

5 marks

Answer: (b) $10\sqrt{3}\ \text{cm}^2$

(a)

$\cos\theta = \frac{5^2 + 8^2 - 7^2}{2(5)(8)}$ M1

$= \frac{40}{80} = \frac{1}{2}$ A1

$\theta = 60°$ A1 AG

(b)

$\frac{1}{2}(5)(8)\sin 60°$ (M1)

$10\sqrt{3}\ \text{cm}^2$ A1

Question 7

7 marks

Answer: (a) 7.44 cm; (b) $26.0\ \text{cm}^2$; (c) $87.6°$

(a)

$BC^2 = 7^2 + 10^2 - 2(7)(10)\cos 48°$ $M1$A1

$BC = 7.44$ cm A1

(b)

$\frac{1}{2}(7)(10)\sin 48°$ (M1)

$26.0\ \text{cm}^2$ A1

(c)

$\frac{\sin B}{10} = \frac{\sin 48°}{7.4378\ldots}$ or cosine rule **(M1)**

$B = 87.6°$ **A1**

Question 8

6 marks

Answer: (a) $22°$; (b) 113 km

1. The bearing of B from A is $248°$, so the bearing of A from M (on the same line) is $248° - 180° = 068°$. **(M1)**
   C is due East of M, i.e. on a bearing of $090°$, so $A\hat{M}C = 090° - 068° = 22°$. **A1**
2. M is the midpoint of $[AB]$, so $AM = \frac{530}{2} = 265$ km. **(A1)**
   Use the cosine rule in $\triangle AMC$: $AC^2 = AM^2 + MC^2 - 2(AM)(MC)\cos A\hat{M}C$. **M1**
   $AC^2 = 265^2 + 300^2 - 2(265)(300)\cos 22° = 160225 - 159000\cos 22°$. **A1**
   $AC^2 = 12803.3\ldots \implies AC = 113.149\ldots \approx 113$ km (3 s.f.). **A1**

Question 9

7 marks

Answer: (a) $47.8°$ or $132°$; (b) 13.8 cm

(a)

$\frac{1}{2}(6)(9)\sin X = 20$ **M1**

$\sin X = \frac{20}{27}$ **A1**

$X = 47.8°$ or $X = 132.2°$ **A1A1**

(b)

use the obtuse angle **(M1)**

$YZ^2 = 6^2 + 9^2 - 2(6)(9)\cos 132.2°$ **M1**

$YZ = 13.8$ cm **A1**

Question 10

8 marks

Answer: (b) 16.8 km; (c) $71.2°$, so bearing $071°$

(a)

angle between the north line at Q and QP is $180° - 40° = 140°$ **M1**

$360° - 140° - 115° = 105°$ **A1 AG**

(b)

$PR^2 = 12^2 + 9^2 - 2(12)(9)\cos 105°$ **M1A1**

$PR = 16.8$ km **A1**

(c)

$\frac{\sin Q\hat{P}R}{9} = \frac{\sin 105°}{16.76\ldots}$ **M1**

$Q\hat{P}R = 31.2°$ **A1**

bearing $40° + 31.2° = 071°$ **A1**

Every solution is also on ibmathrevision.com/slaa/non-right-angled-trigonometry-exam-practice
Our own original questions, written and checked by IB Math Revision. IB Math Revision is independent and is not affiliated with, endorsed by or connected to the International Baccalaureate Organization. This work/product/service has been developed independently from and is not endorsed by the International Baccalaureate Organization. International Baccalaureate, Baccalauréat International, Bachillerato Internacional and IB are registered trademarks owned by the International Baccalaureate Organization.