Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Sine rule, cosine rule and area of a triangle

Time allowed: 1 hour 20 minutes

Subject code **0580**

Mathematics

Questions from Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 64

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 64 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

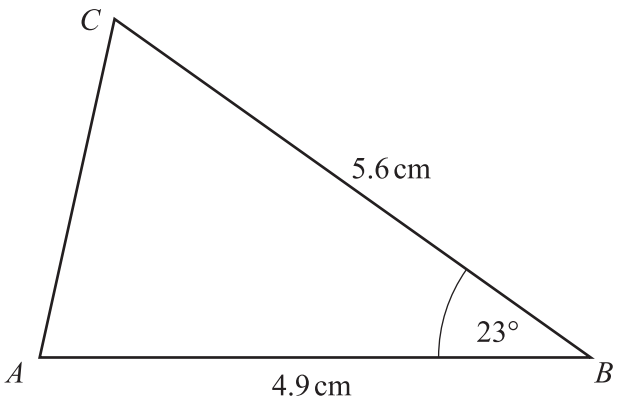
Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1



NOT TO SCALE

Calculate the area of triangle ABC.

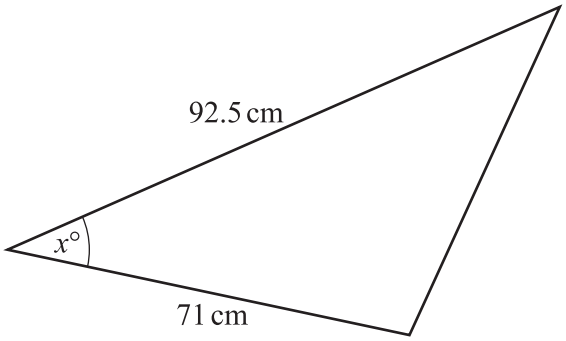
..... cm^2 [2]

Area of a triangle Click for more variations

1	5.36 or 5.360 to 5.361	**2**	**M1** for $\frac{1}{2}\times 5.6\times 4.9\times \sin 23$ oe

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2



NOT TO SCALE

The diagram shows a triangle with an acute angle marked $x°$.
The area of the triangle is $2143\,\text{cm}^2$.

Work out the value of x.

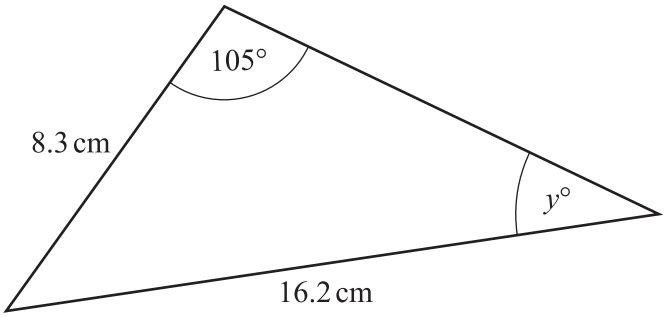
$x =$ ..... [2]

Area of a triangle Click for more variations

2	40.7 or 40.73 to 40.74	**2**	**M1** for $\frac{1}{2} \times 92.5 \times 71 \sin x = 2143$ oe

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3



NOT TO SCALE

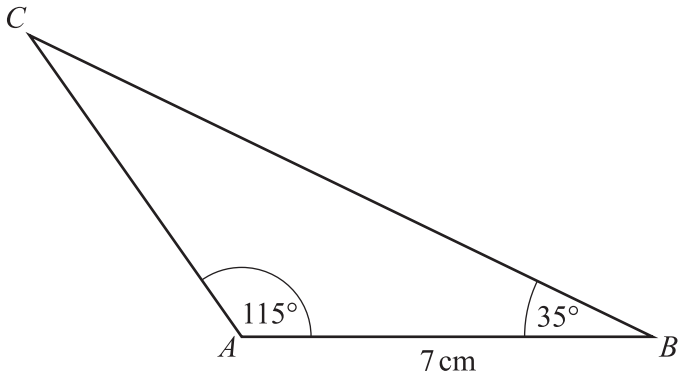
Calculate the value of y.

$y =$ ..... [3]

The sine rule Click for more variations

3	29.7 or 29.66[...]	**3**	**M2** for $[\sin y =]\ \frac{8.3\sin 105}{16.2}$ or **M1** for $\frac{16.2}{\sin 105} = \frac{8.3}{\sin y}$ oe

4



NOT TO SCALE

Calculate the length BC.

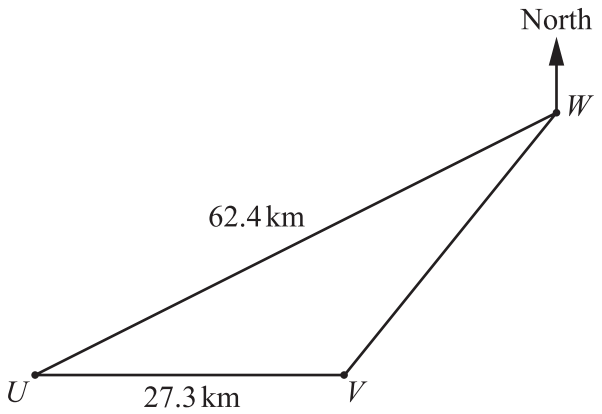
$BC =$ ..... cm [4]

The sine rule Click for more variations

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4	12.7 or 12.68 to 12.69	**4**	**M3** for $\frac{7\sin 115}{\sin(180-115-35)}$ or **B2** for 8.03… seen OR **B1** for [angle C =] 30 **M2** for $\frac{7\sin 115}{\sin(\textit{their}\ \text{angle}\ C)}$ or **M1** for $\frac{\sin 115}{BC}=\frac{\sin(\textit{their}\ \text{angle}\ C)}{7}$ oe

5



NOT TO SCALE

The diagram shows the position of three towns, U, V and W.
U is due west of V and angle $UVW = 125°$.

Calculate the bearing of U from W.

..... [4]

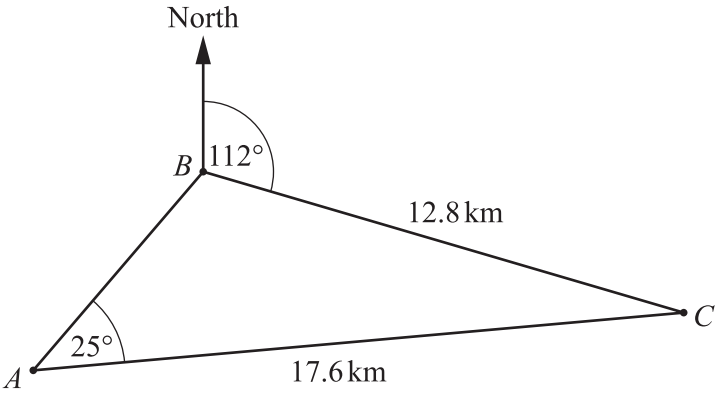
The sine rule Click for more variations

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5	236[.0…]	**4**	**M2** for $\frac{27.3\times \sin 125}{62.4}$ or **M1** for $\frac{27.3}{\sin UWV}=\frac{62.4}{\sin 125}$ **M1** for $180+(125-90)+$ *their* 21 oe or $180+(90-$ *their* $34)$ oe If 0 scored **SC1** for the correct bearing marked at W

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6



NOT TO SCALE

The diagram shows the positions of three ships A, B and C.
$AC = 17.6$ km, $BC = 12.8$ km and angle $BAC = 25°$.
The bearing of C from B is 112° and angle ABC is obtuse.

Calculate the bearing of B from A.

..... [5]

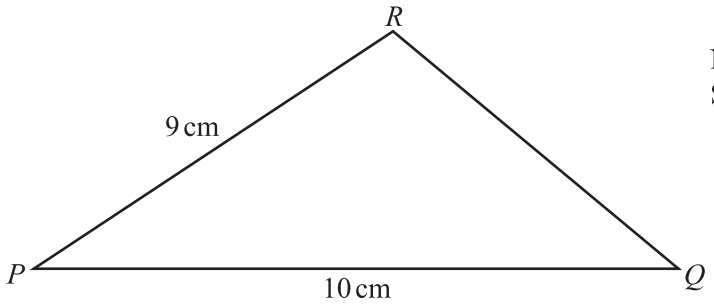
The sine rule Click for more variations

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6	076 or 076.4 to 076.5	**5**	**B3** for [angle ABC =] 144 or 144.4 to 144.5 OR **M2** for [sin ABC =] $\frac{17.6\sin 25}{12.8}$ oe or **M1** for $\frac{17.6}{\sin B}=\frac{12.8}{\sin 25}$ oe **M1** for $180 - $ *their* 35.5 AND **M1** for *their* angle $ABC - (180 - 112)$ oe

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7



NOT TO SCALE

The area of triangle PQR is $38.5\,\text{cm}^2$.

Calculate the length QR.

Answer QR = ... cm [6]

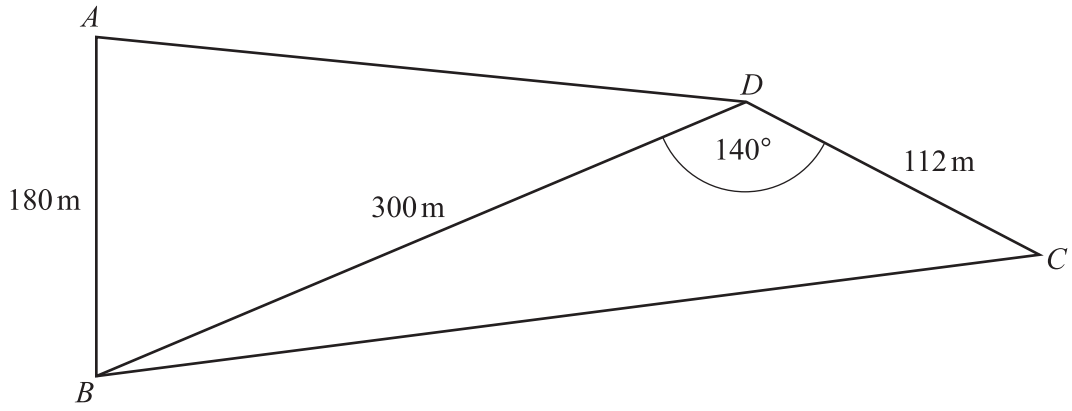
The cosine rule Click for more variations

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7	9.37 or 9.370 to 9.371	**6**	**M2** for $\sin[P] = \dfrac{38.5}{0.5\times 9\times 10}$ or **M1** for $0.5 \times 10 \times 9 \times \sin = 38.5$ **M3** for $\sqrt{(9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P))}$ or **M2** for $9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P)$ or **M1** for a correct implicit expression e.g. $\cos(\textit{their } P) = \dfrac{9^2 + 10^2 - RQ^2}{2\times 9\times 10}$ Note: 87.8, 87.81[…] or 87.7[55…] score 4 marks or M is foot of perpendicular from R to PQ **M2** for perp.ht $= 38.5 \div \frac{1}{2} \times 10$ or 7.7 or **M1** for $\frac{1}{2} \times 10 \times […] = 38.5$ **M1** for $PM = \sqrt{(9^2 - 7.7^2)}$[= 4.659… or 4.66] **M1** for $QM = 10 - \textit{their}$ 4.659…[= 5.34…] **M1** for $QR = \sqrt{((\textit{their } QM)^2 + 7.7^2)}$

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8



NOT TO SCALE

The diagram shows a field, *ABCD*, in the shape of a quadrilateral.
BD is a straight path across the field.

(a) Calculate *BC*.

BC = ... m [3]

(b) Calculate angle *DBC*.

Angle *DBC* = ... [3]

(c) The total area of the field, *ABCD*, is 35 900 m^2.

Work out the length of the shortest distance from *D* to *AB*.

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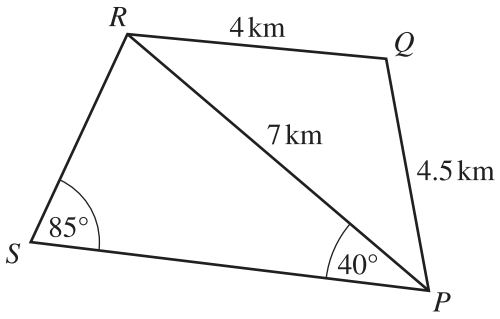
..... m [4]

(a) The cosine rule (b) The sine rule (c) SOHCAHTOA Click for more variations

8(a)	392 or 392.4 to 392.5	**3**	**M2** for $\sqrt{300^2+112^2-2\times300\times112\times\cos140}$ OR **M1** for $300^2+112^2-2\times300\times112\times\cos140$ **A1** for 154 022[…]
8(b)	10.6 or 10.7 or 10.55 to 10.69	**3**	**M2** for $\frac{112\sin140}{their\ \textbf{(a)}}$ oe or $\cos[DBC]=\frac{300^2+(their\ \textbf{(a)})^2-112^2}{2\times300\times their\ \textbf{(a)}}$ or **M1** for $\frac{112}{\sin DBC}=\frac{their\ \textbf{(a)}}{\sin140}$ oe or $112^2=300^2+(their\ \textbf{(a)})^2-2\times300\times their\ \textbf{(a)}\times\cos DBC$ oe
8(c)	279 or 278.9…	**4**	**M3** for $(35\,900-\frac{1}{2}\times112\times300\times\sin140)\div\left(\frac{1}{2}\times180\right)$ oe OR **M1** for $\frac{1}{2}\times112\times300\times\sin140$ oe **M1** for recognition that the shortest distance from D is perpendicular to AB

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9



NOT TO SCALE

The diagram shows five straight roads.
$PQ = 4.5$ km, $QR = 4$ km and $PR = 7$ km.
Angle $RPS = 40°$ and angle $PSR = 85°$.

(a) Calculate angle PQR and show that it rounds to 110.7°.

Answer(a)

[4]

(b) Calculate the length of the road RS and show that it rounds to 4.52 km.

Answer(b)

[3]

(c) Calculate the area of the quadrilateral $PQRS$.
[Use the value of 110.7° for angle PQR and the value of 4.52 km for RS.]

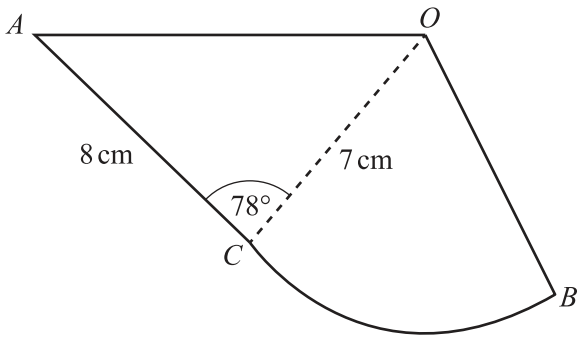
Answer(c) ..... km^2 [5]

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(a) The cosine rule (b) The sine rule (c) Area of a triangle Click for more variations

9	**(a)** $(\cos Q =)\dfrac{4^2 + 4.5^2 - 7^2}{2 \times 4 \times 4.5}$ o.e. 110.74….	M2 E2	**M1** for $7^2 = 4^2 + 4.5^2 - 2 \times 4 \times 4.5 \times \cos(Q)$ If **E0** then **A1** for – 0.354(1….)
	(b) $(RS =)\dfrac{7 \sin 40}{\sin 85}$ 4.516 …	M2 E1	**M1** for $\dfrac{RS}{\sin 40} = \dfrac{7}{\sin 85}$ o.e. Can be implied by second M
	(c) Angle $R = 55°$ $0.5 \times 7 \times 4.52 \times \sin(\text{their } 55)$ o.e. $0.5 \times 4 \times 4.5 \times \sin 110.7$ o.e. Triangle PRS + Triangle PQR 21.4 (21.36 – 21.42)	B1 M1 M1 M1 A1	(May be seen on diagram) (12.95 – 13.0) their 55 is (180 – 40 – 85) (8.418 – 8.42) ($s = 7.75$) Dependent on M1, M1 www 5

10



NOT TO SCALE

The diagram shows a design made from a triangle AOC joined to a sector OCB.
$AC = 8$ cm, $OB = OC = 7$ cm and angle $ACO = 78°$.

(a) Use the cosine rule to show that $OA = 9.47$ cm, correct to 2 decimal places.

[4]

(b) Calculate angle OAC.

Angle $OAC =$ ..... [3]

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(c) The perimeter of the design is 29.5 cm.

Show that angle $COB = 41.2°$, correct to 1 decimal place.

[5]

(d) Calculate the total area of the design.

..... cm^2 [4]

(a) The cosine rule (b) The sine rule (c) Arc length and sector area (d) Area of a triangle

Click for more variations

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10(a)	$8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 78$ oe	**M2**	**M1** for correct implicit version
	9.471.. to 9.472	**A2**	**A1** for 89.7…
10(b)	46.3 or 46.29 to 46.30…	**3**	**M2** for $[\sin OAC =]\frac{7\sin 78}{9.47}$ or **M1** for $\frac{\sin OAC}{7}=\frac{\sin 78}{9.47}$

10(c)	$29.5 - (7 + 8 + 9.47)$	**M1**	
	$\frac{360\times(29.5-(7+8+9.47))}{2\times\pi\times 7}$	**M3**	**M2** for $\frac{x}{360}\times 2\times\pi\times 7 =$ *their* arc length oe or **M1** for $\frac{x}{360}\times 2\times\pi\times 7$ oe
	41.15 to 41.171..	**B1**	
10(d)	45[.0] or 44.98 to 45.01 nfww	**4**	**M3** for ½ × 8 × 7 × sin 78 oe + $\frac{41.2}{360}\times\pi\times 7^2$ oe OR **M1** for ½ × 8 × 7 × sin 78 oe or ½ × 8 × 9.47 × sin *their* **(b)** oe **M1** for $\frac{41.2}{360}\times\pi\times 7^2$ oe

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