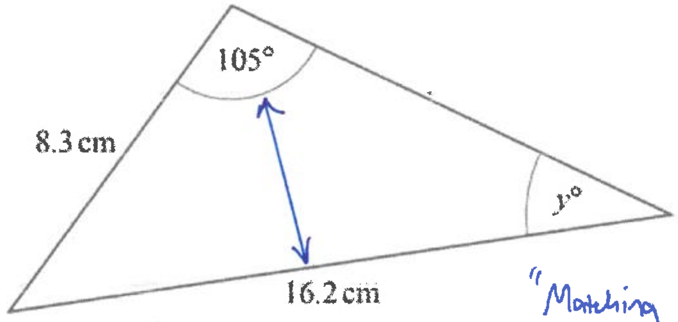
18 Sine Rule for Angles: $\frac{\sin A}{a} = \frac{\sin B}{b}$ Sine Rule for Sides: $\frac{a}{\sin A} = \frac{b}{\sin B}$



NOT TO SCALE

"Matching pair" of angle and side opposite means we can use the Sine rule.

Calculate the value of y.

$\frac{\sin y}{8.3} = \frac{\sin 105}{16.2}$ ×8.3 ×8.3

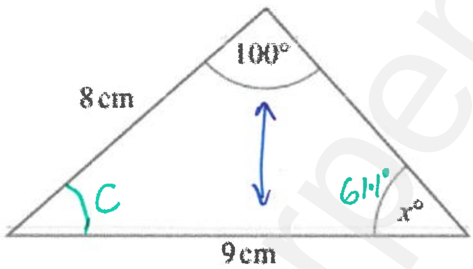
$\sin y = \frac{8.3 \sin 105}{16.2}$

$y = \sin^{-1}\left(\frac{8.3\sin 105}{16.2}\right)$

$= \underline{29.7°}$

$y =$ ....29.7°.... [3]

19



NOT TO SCALE

(a) Calculate the value of x.

$\frac{\sin x}{8} = \frac{\sin 100}{9}$ ×8 ×8

$\sin x = \frac{8 \sin 100}{9}$

$x = \sin^{-1}\left(\frac{8\sin 100}{9}\right)$

$x = 61.1°$

$x =$ ....61.1°.... [3]

(b) Calculate the area of the triangle.

$180 - (61.1 + 100) = 18.9°$

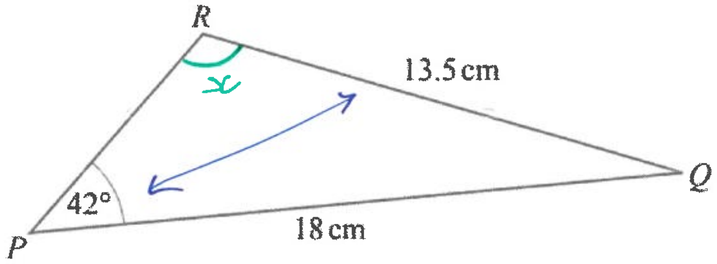
Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2} \times 8 \times 9 \times \sin 18.9$

$= \underline{11.7\text{cm}^2}$

....11.7.... cm² [3]

19



NOT TO SCALE

Calculate the obtuse angle PRQ.

$$\frac{\sin x}{18} = \frac{\sin 42}{13.5} \quad \times 18 \quad \times 18$$

$$\sin x = \frac{18 \sin 42}{13.5}$$

$$x = \sin^{-1}\left(\frac{18\sin 42}{13.5}\right)$$

$$= 63.1°$$

obtuse so:

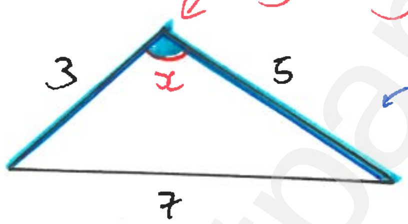
$180 - 63.1° = \underline{116.9°}$

Angle PRQ = 116.9° [4]

15 A triangle has sides of length 3 cm, 5 cm and 7 cm.

Work out the largest angle in the triangle.

largest angle is opposite the largest side.



SAS (side - angle - side) so we can use Cosine rule:

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

$$7^2 = 3^2 + 5^2 - 2(3)(5)\cos x$$

$$49 = 9 + 25 - 30\cos x$$

$$49 = 34 - 30\cos x$$

$-34 \quad -34$

$$15 = -30\cos x$$

$\div -30 \quad \div -30$

$$-\frac{1}{2} = \cos x$$

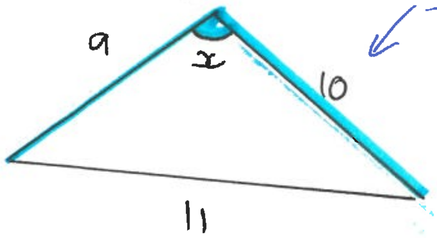
$$x = \cos^{-1}\left(-\frac{1}{2}\right)$$

$$= 120$$

120° [3]

23 A triangle has sides of length 11 cm, 10 cm and 9 cm.

Calculate the largest angle in the triangle.



SAS → Cosine Rule:

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

$11^2 = 9^2 + 10^2 - 2 \times 9 \times 10 \cos x$

$121 = 181 - 180 \cos x$

$-181 \quad -181$

$-60 = -180 \cos x$

$\div -180 \quad \div -180$

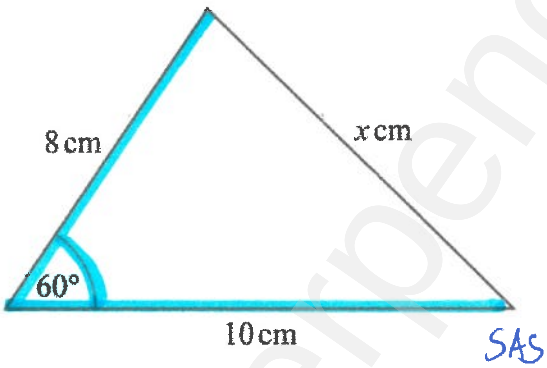
$\cos x = \frac{1}{3}$

$x = \cos^{-1}\left(\frac{1}{3}\right)$

$= \underline{70.5}$

.... $70.5°$ .... [4]

11 Non-Calculator



NOT TO SCALE

Find the value of x^2.

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

$x^2 = 8^2 + 10^2 - 2 \times 8 \times 10 \times \cos 60$

$x^2 = 64 + 100 - 160 \cos 60$

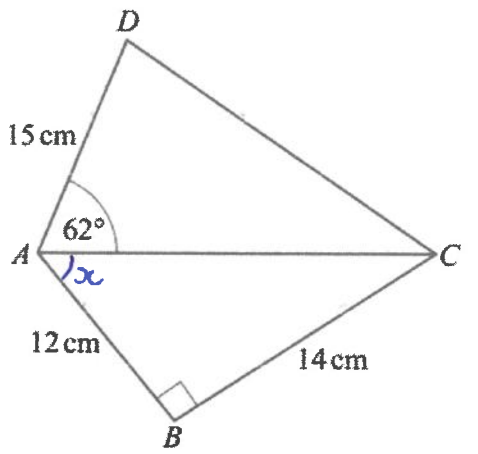
$= 164 - 160 \times \frac{1}{2}$

$= 164 - 80$

$= \underline{84}$

$x^2 =$ .... 84 .... [3]

13

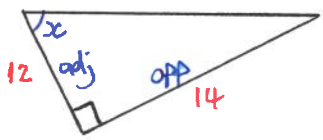


NOT TO SCALE

The diagram shows a quadrilateral, $ABCD$, formed from two triangles, ABC and ACD.
ABC is a right-angled triangle.

(a) Calculate angle BAC.

$S^{O}_{H}C^{A}_{H}T^{O}_{A}$



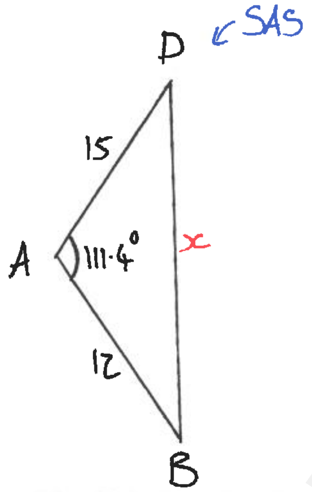
$\tan x = \dfrac{14}{12}$

$x = \tan^{-1}\left(\dfrac{14}{12}\right)$

$= 49.4°$

Angle BAC = ...49.4°...... [2]

(b) Calculate BD.



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

$x^2 = 12^2 + 15^2 - 2 \times 12 \times 15 \times \cos(111.4)$

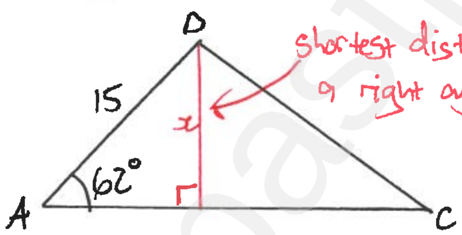
$x^2 = 369 - 360\cos(111.4)$

$x = \sqrt{369 - 360\cos(111.4)}$

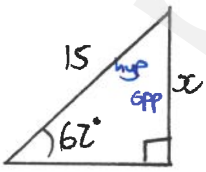
$= 22.4$ cm

BD = ...22.4...... cm [4]

(c) Calculate the shortest distance from D to AC.



shortest distance always makes a right angle with AC



$S^{O}_{H}C^{A}_{H}T^{O}_{A}$

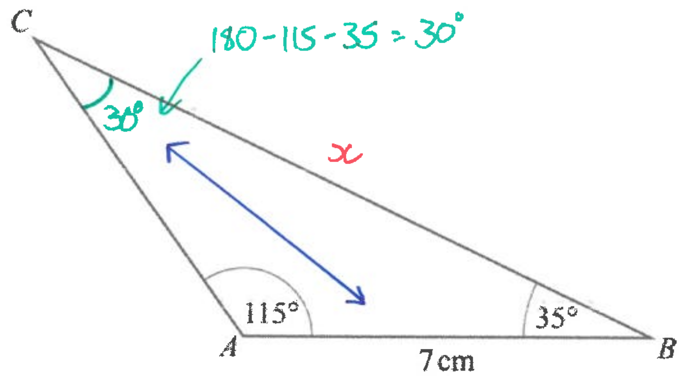
$\sin 62 = \dfrac{x}{15}$ ×15 ×15

$x = 15\sin 62$

$= 13.2$ cm

......13.2...... cm [3]

18



NOT TO SCALE

Calculate the length BC.

$$\frac{x}{\sin 115} = \frac{7}{\sin 30}$$

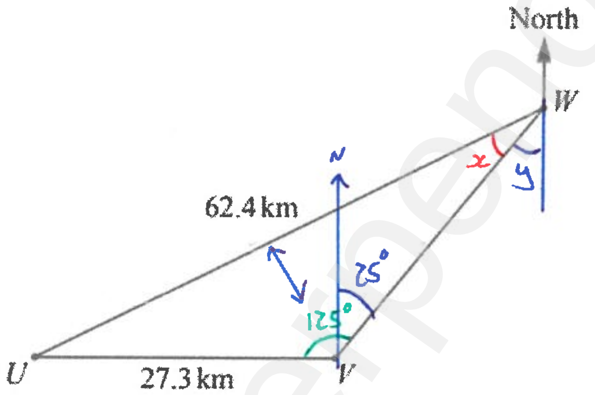
$\times \sin 115$ $\times \sin 115$

$$x = \frac{7\sin 115}{\sin 30}$$

$x = \underline{12.7\text{cm}}$

$BC =$ ....12.7........ cm [4]

18



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.

$$\frac{\sin x}{27.3} = \frac{\sin 125}{62.4}$$

$\times 27.3$ $\times 27.3$

$$\sin x = \frac{27.3\sin 125}{62.4}$$

$$x = \sin^{-1}\left(\frac{27.3\sin 125}{62.4}\right)$$

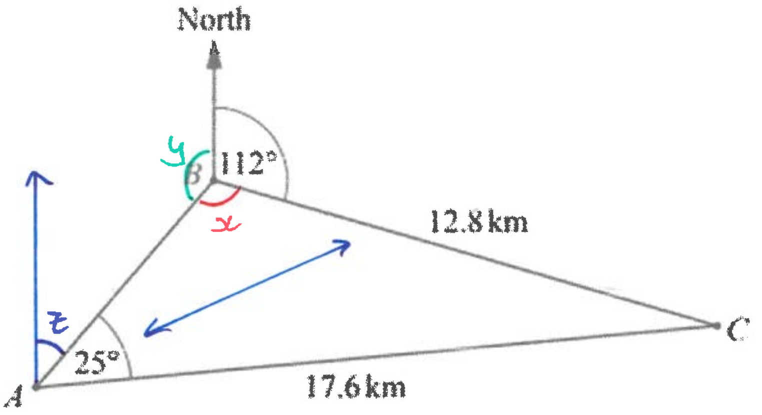
$\underline{x = 21.0°}$

Angle $y = 25°$ (alternate angles)

Bearing of U from $W = 180 + 25 + 21$
$= \underline{226°}$

........226°........ [4]

21



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.

x:

$$\frac{\sin x}{17.6} = \frac{\sin 25}{12.8} \quad \times 17.6 \quad \times 17.6$$

$$\sin x = \frac{17.6 \sin 25}{12.8}$$

$$x = \sin^{-1}\left(\frac{17.6 \sin 25}{12.8}\right)$$

$$= 35.5°$$

but x is obtuse, so:

$$x = 180 - 35.5$$

$$= \underline{144.5°}$$

y:

$$y = 360 - (112 + 144.5)$$

$$= \underline{103.5°}$$

z:

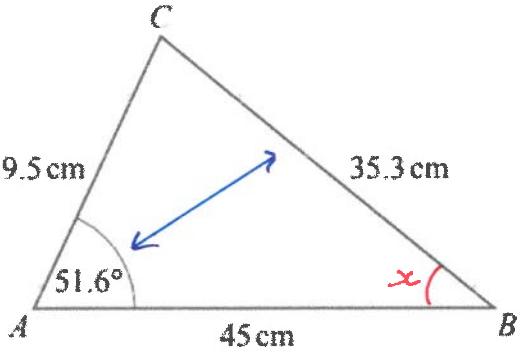
Co-interior angle sum to 180°, so

$$z = 180 - 103.5$$

$$= \underline{76.5°}$$

076.5° [5]

4 (a)



NOT TO SCALE

In triangle ABC, $AB = 45$ cm, $AC = 29.5$ cm, $BC = 35.3$ cm and angle $CAB = 51.6°$.

(i) Calculate angle ABC.

$$\frac{\sin x}{29.5} = \frac{\sin 51.6}{35.3}$$

$\times 29.5$ $\times 29.5$

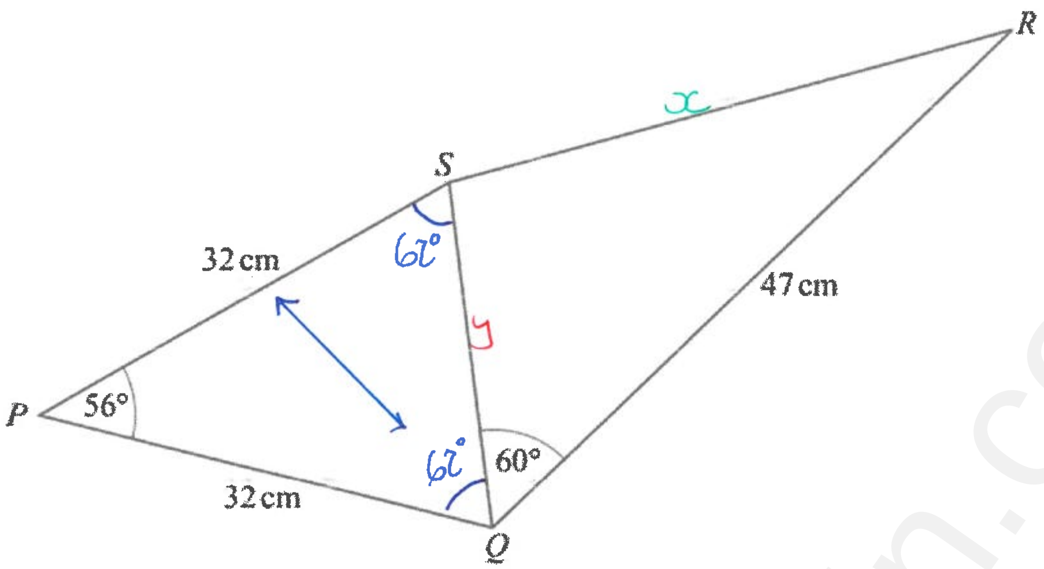
$$\sin x = \frac{29.5 \sin 51.6}{35.3}$$

$$x = \sin^{-1}\left(\frac{29.5 \sin 51.6}{35.3}\right)$$

$$= 40.9°$$

Angle ABC = 40.9° [3]

(b)



The diagram shows a quadrilateral *PQRS* formed from two triangles, *PQS* and *QRS*.
Triangle *PQS* is isosceles, with $PQ = PS = 32$ cm and angle $SPQ = 56°$.
$QR = 47$ cm and angle $SQR = 60°$.

(i) Calculate *SR*.

PQS is isosceles, so

$P\hat{S}Q = P\hat{Q}S$:

$180 - 56 = 124$

$124 \div 2 = 62°$

y:

$$\frac{y}{\sin 56} = \frac{32}{\sin 62}$$

×sin56 ×sin56

$$y = \frac{32 \sin 56}{\sin 62}$$

$$= 30.046\ldots$$

STO

x: cosine rule:

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

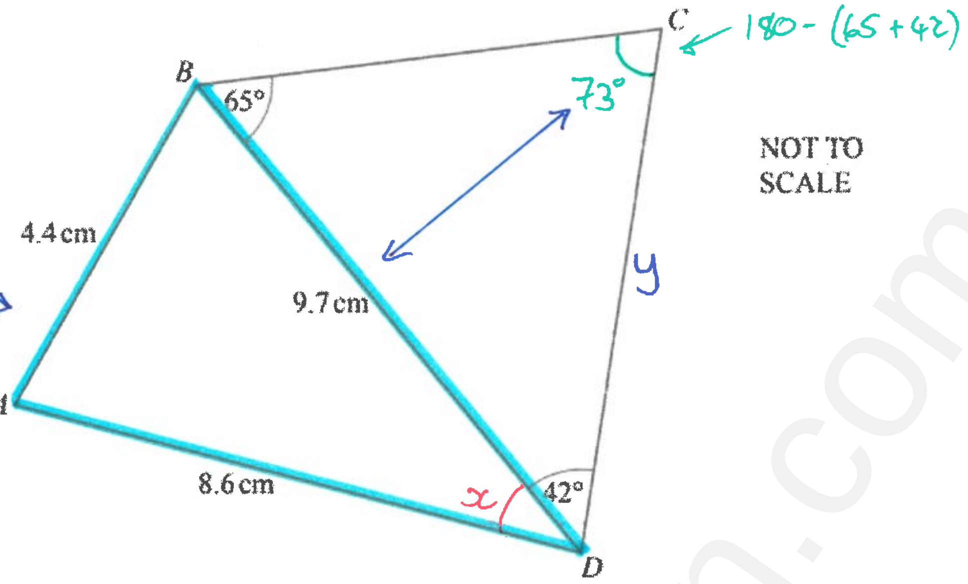
$$x^2 = 47^2 + (30.046..)^2 - 2 \times 47 \times 30.046.. \times \cos(60)$$

$$x = \sqrt{47^2 + (30.046..)^2 - 2 \times 47 \times 30.046.. \cos(60)}$$

$$= 41.2\text{cm}$$

$SR =$ ......41.2...... cm [4]

5



NOT TO SCALE

SSS

so can use cosine rule to find missing angle

(a) Calculate angle *ADB*.

Cosine rule:

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

$4.4^2 = 8.6^2 + 9.7^2 - 2 \times 8.6 \times 9.7 \cos x$

$19.36 = 168.05 - 166.84 \cos x$

$-168.05 \quad -168.05$

$-148.69 = -166.84 \cos x$

$\div -166.84 \quad \div -166.84$

$\cos x = \dfrac{148.69}{166.84}$

$x = 26.97...$

Angle *ADB* = ...27.0°........ [3]

(b) Calculate *DC*.

$\dfrac{y}{\sin 65} = \dfrac{9.7}{\sin 73}$

$\times \sin 65 \quad \times \sin 65$

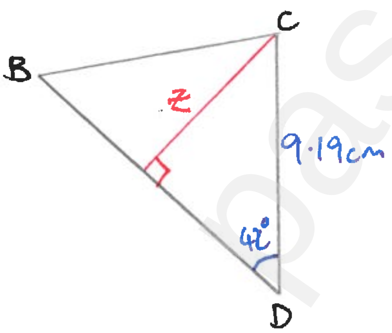
$y = \dfrac{9.7 \sin 65}{\sin 73}$

$y = 9.19\text{cm}$

STO

DC = ...9.19........ cm [4]

(c) Calculate the shortest distance from *C* to *BD*.



$S^O_H C^A_H T^O_A$

$\sin 42 = \dfrac{z}{9.19...}$

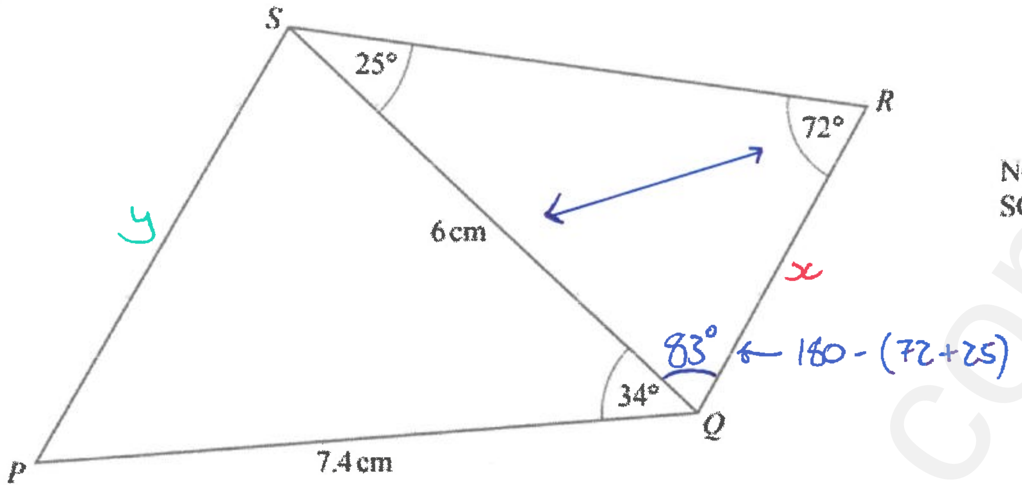
$\times 9.19.. \quad \times 9.19..$

$z = (9.19..) \times \sin 42$

$= 6.15\text{cm}$

........6.15........ cm [3]

8 **(a)**



NOT TO SCALE

The diagram shows a quadrilateral *PQRS* formed from two triangles, *PQS* and *QRS*.

Calculate

(i) *QR*,

$$\frac{x}{\sin 25} = \frac{6}{\sin 72}$$

$\times \sin 25$ $\times \sin 25$

$$x = \frac{6\sin 25}{\sin 72}$$

$x = \underline{2.67\text{cm}}$ STO

QR = ...2.67........ cm [3]

(ii) *PS*,

<u>cosine rule:</u>

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

$$y^2 = 6^2 + 7.4^2 - 2\times 6\times 7.4\times \cos 34$$

$$y = \sqrt{90.76 - 88.8\cos 34}$$

$$= \underline{4.14\text{cm}}$$

PS = ...4.14........ cm [3]

(iii) the area of quadrilateral *PQRS*.

<u>Δ PQS:</u> Area $= \frac{1}{2}ab\sin C$

$$= \frac{1}{2}\times 6\times 7.4\times \sin 34$$

$$= \underline{12.414\text{ cm}^2}$$

<u>Δ QRS:</u> Area $= \frac{1}{2}ab\sin C$

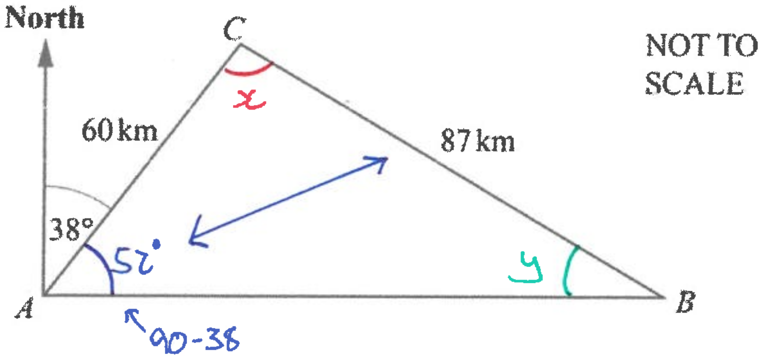
$$= \frac{1}{2}\times 6\times (2.66...)\times \sin 83$$

$$= \underline{7.939\text{ cm}^2}$$

Total: $12.414 + 7.939$ = ...$\underline{20.4}$........ cm^2 [4]

(3sf)

7



The diagram shows the straight roads between town A, town B and town C.
$AC = 60$ km, $CB = 87$ km and B is due east of A.
The bearing of C from A is 038°.

(a) Show that angle $ACB = 95.1°$, correct to 1 decimal place.

y:

$$\frac{\sin y}{60} = \frac{\sin 52}{87} \quad \times 60$$

$$\sin y = \frac{60 \sin 52}{87}$$

$$y = \sin^{-1}\left(\frac{60\sin 52}{87}\right)$$

$$= 32.919°$$

x:

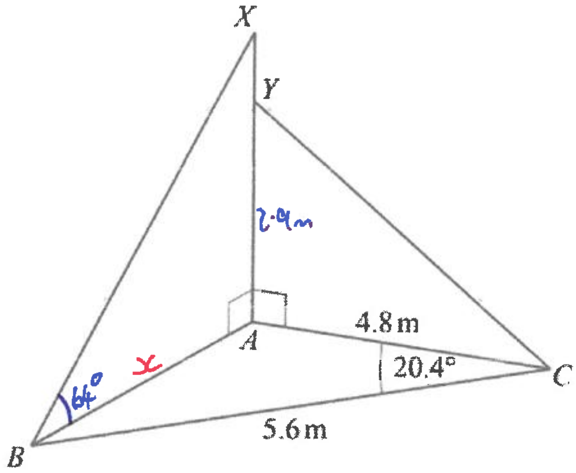
$$x = 180 - (52 + 32.919..)$$

$$= 95.08...$$

$$= 95.1° \text{ to 1dp}$$

[5]

5 **(a)**



NOT TO SCALE

ABC is a scalene triangle on horizontal ground.
AYX is a straight vertical post, held in place by two straight wires XB and YC.
$AC = 4.8$ m, $BC = 5.6$ m and angle $ACB = 20.4°$.

(i) Calculate AB.

Cosine Rule: $a^2 = b^2 + c^2 - 2bc\cos A$

$x^2 = 4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \cos 20.4$

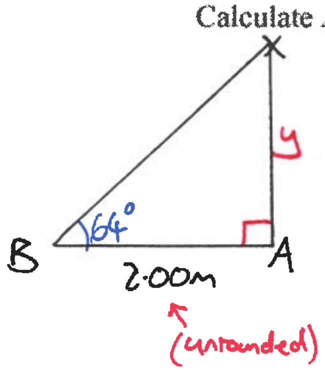
$x = \sqrt{54.4 - 53.76 \cos 20.4}$

$= 2.00$ m STO

$AB =$ ......2.00...... m [3]

(ii) Angle $XBA = 64°$.

Calculate AX. SOH CAH TOA



$\tan 64 = \frac{y}{2.00...}$ ×2.00 ×2.00

$y = 2.00... \tan 64$

$= 4.1066..$

$= 4.11$ m

$AX =$ ......4.11...... m [2]

(iii) $AY = 2.9$ m.

Calculate the area of triangle YAC.

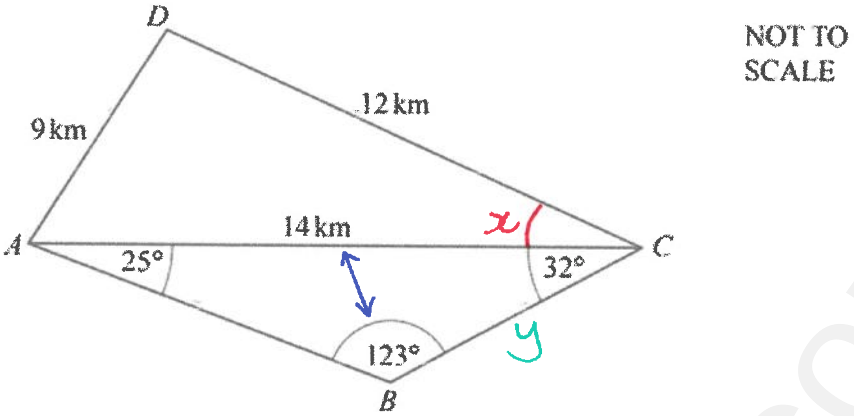
Area $= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 4.8 \times 2.9$

$= 6.96 m^2$

......6.96...... m^2 [2]

7



(a) Calculate angle *ACD*. SSS → cosine rule:

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

$9^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \times \cos x$

$81 = 340 - 336\cos x$

$-340 \qquad -340$

$-259 = -336\cos x$

$\div -336 \qquad \div -336$

$\cos x = \dfrac{259}{336}$

$x = \cos^{-1}\left(\dfrac{259}{336}\right)$

$= 39.6^\circ$

Angle *ACD* = ... 39.6° .... [4]

(b) Show that *BC* = 7.05 km, correct to 2 decimal places.

$\dfrac{y}{\sin 25} = \dfrac{14}{\sin 123}$

$\times \sin 25 \qquad \times \sin 25$

$y = \dfrac{14\sin 25}{\sin 123}$

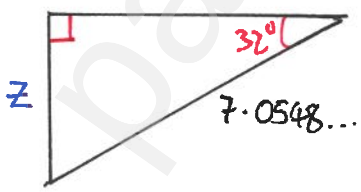
$= 7.0548\ldots$

$= 7.05$ (to 2dp)

STO

[3]

(c) Calculate the shortest distance from *B* to *AC*.



$S^O_H\ C^A_H\ T^O_A$

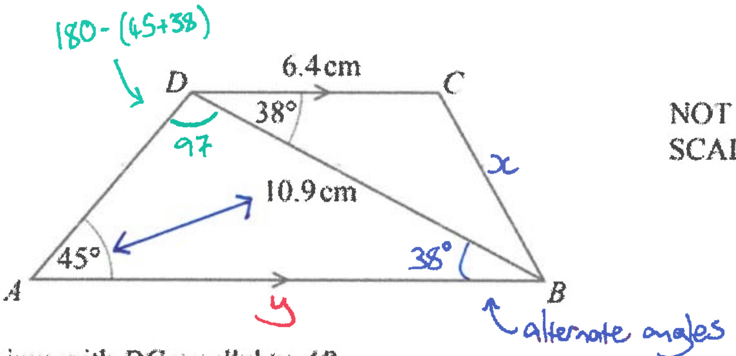
$\sin 32 = \dfrac{z}{7.0548\ldots}$

$\times 7.0548\ldots \qquad \times 7.0548\ldots$

$z = 7.0548\ldots \sin 32$

3.74 km

.... 3.74 .... km [3]



NOT TO SCALE

ABCD is a trapezium with *DC* parallel to *AB*.
DC = 6.4 cm, *DB* = 10.9 cm, angle *CDB* = 38° and angle *DAB* = 45°.

(a) Find *CB*.

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

$$x^2 = 6.4^2 + 10.9^2 - 2\times 6.4\times 10.9\times\cos 38$$

$$x = \sqrt{159.77 - 139.52\cos 38}$$

$$= 7.06\text{ cm}$$

CB = ...7.06........ cm [3]

(b) **(i)** Find angle *ADB*.

alternate angles are equal, so
ABD = 38°

$180 - (45 + 38) = 97°$

Angle *ADB* = ...97°........ [1]

(ii) Find *AB*.

$$\frac{y}{\sin 97} = \frac{10.9}{\sin 45}$$

×sin97 ×sin97

$$y = \frac{10.9\sin 97}{\sin 45}$$

y = 15.3 cm

AB = ...15.3........ cm [3]

(c) Calculate the area of the trapezium.

△ABD: Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2}\times 10.9\times 15.3\sin 38$

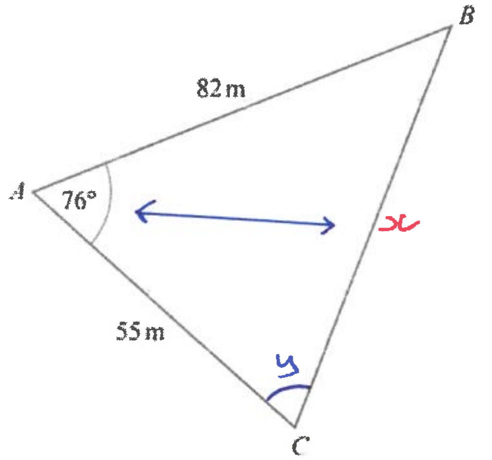
$= 51.337$

△BDC: Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2}\times 6.4\times 10.9\times\sin 38$

$= 21.474$

Total: 51.337 + 21.474 = ...72.8........ cm² [3]



NOT TO SCALE

The diagram shows a field *ABC*.

x:
Cosine rule:

(a) Calculate *BC*.

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

$x^2 = 55^2 + 82^2 - 2 \times 55 \times 82 \times \cos 76$

$x = \sqrt{9749 - 9020\cos 76}$

$x = 87.0\text{m}$ STO

BC = 87.0 m [3]

(b) Calculate angle *ACB*.

y:
Sine rule:

$\dfrac{\sin y}{82} = \dfrac{\sin 76}{86.987..}$ ← from (a)

$\times 82$ $\times 82$

$\sin y = \dfrac{82\sin 76}{86.987..}$

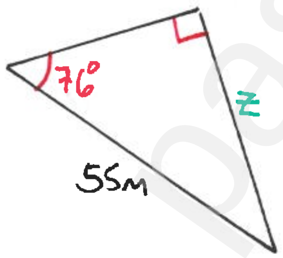
$y = \sin^{-1}\left(\dfrac{82\sin 76}{86.987..}\right)$

$= 66.2°$

Angle *ACB* = 66.2° [3]

(c) A gate, *G*, lies on *AB* at the shortest distance from *C*.

Calculate *AG*. $S^O{}_H C^A{}_H T^O{}_A$



$\sin 76 = \dfrac{z}{55}$

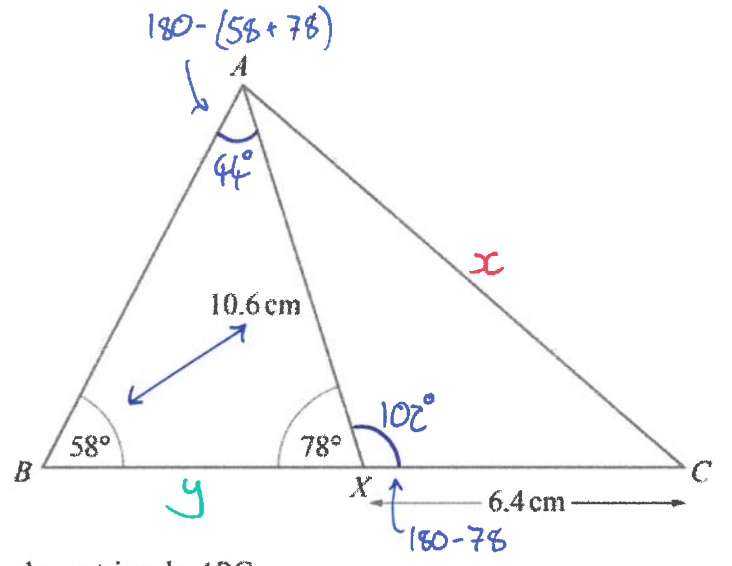
$\times 55$ $\times 55$

$z = 55\sin 76$

$= 53.4\text{m}$

AG = 53.4 m [3]

5



NOT TO SCALE

The diagram shows triangle ABC.
X is a point on BC.
$AX = 10.6$ cm, $XC = 6.4$ cm, angle $ABC = 58°$ and angle $AXB = 78°$.

x:

(a) Calculate AC.

Cosine rule:

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

$x^2 = 6.4^2 + 10.6^2 - 2\times6.4\times10.6\cos102$

$x = \sqrt{153.32 - 135.68\cos102}$

$= 13.5$ cm

$AC =$ ....13.5........ cm [4]

(b) Calculate BX.

y:

$\frac{y}{\sin44} = \frac{10.6}{\sin58}$

×Sin44 ×Sin44

$y = \frac{10.6\sin44}{\sin58}$

$= 8.68$ cm STO

$BX =$ ....8.68........ cm [4]

(c) Calculate the area of triangle ABC.

ΔABX: Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2}\times10.6\times8.68..\times\sin78$

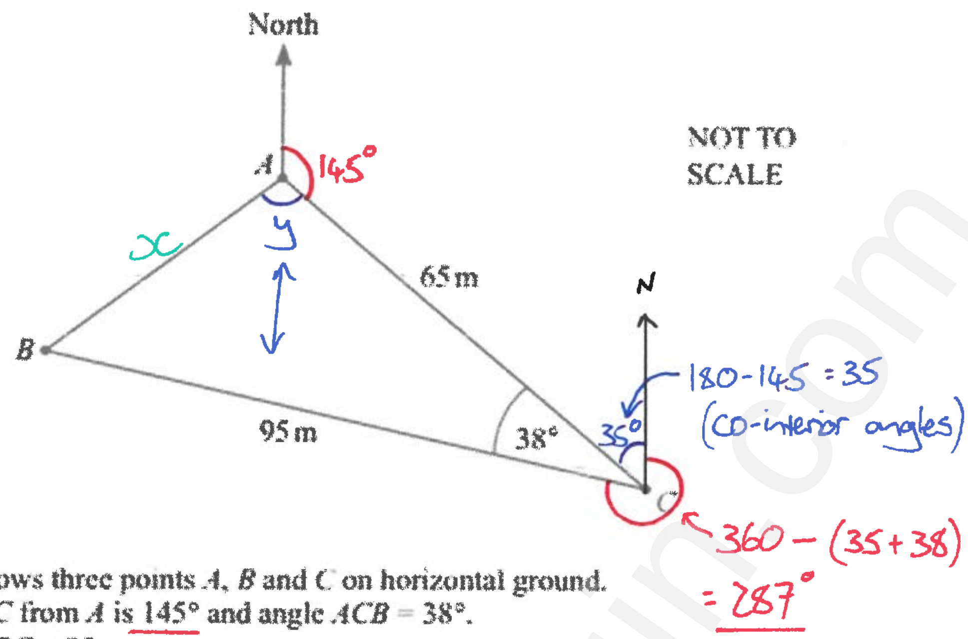
$= 45.013$

ΔACX: Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2}\times10.6\times6.4\times\sin102$

$= 33.179$

Total: $45.013 + 33.179 =$ ....78.2.... cm^2 [3]



The diagram shows three points A, B and C on horizontal ground.
The bearing of C from A is 145° and angle ACB = 38°.
AC = 65 m and BC = 95 m.

(a) Find the bearing of B from C.

See diagram for working.

287° .... [2]

(b) Show that AB = 59.3 m, correct to 1 decimal place.

x:
cosine rule:

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$x^2 = 65^2 + 95^2 - 2\times65\times95\times\cos 38$$
$$x = \sqrt{13250 - 12350\cos 38}$$

$x = 59.313$
$= 59.3$ to 1dp
STO

[3]

(c) Angle BAC is obtuse.

Work out the bearing of B from A.

y:

$$\frac{\sin y}{95} = \frac{\sin 38}{59.3\ldots}$$
×95 ×95

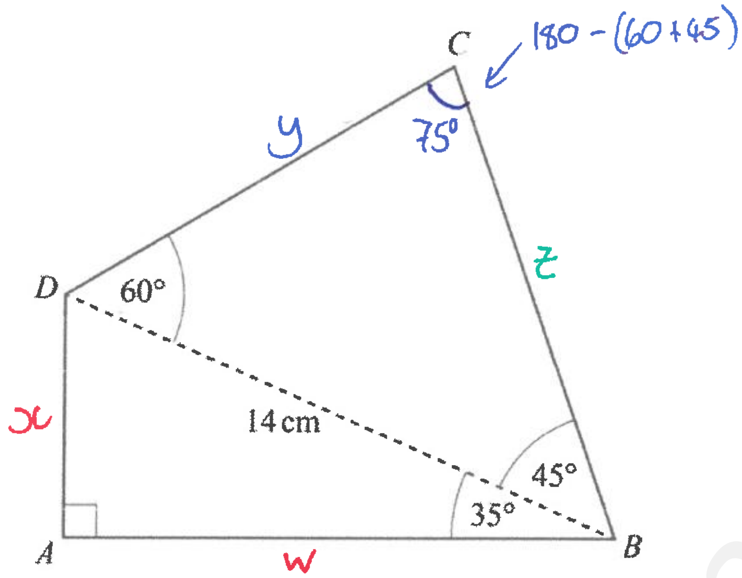
$$\sin y = \frac{95\sin 38}{59.3\ldots}$$
$$y = \sin^{-1}\left(\frac{95\sin 38}{59.3\ldots}\right)$$
$$= 80.4°$$

BAC is obtuse, so:
$180 - 80.4 = 99.6°$

Bearing of B from A:
$145 + 99.6 = 244.6°$

244.6° .... [4]

9 (a)



NOT TO SCALE

Calculate the perimeter of the quadrilateral *ABCD*.

x: SOH CAH TOA

$\sin 35 = \frac{x}{14}$ ×14 ×14

$x = 14\sin 35$

$= 8.0301\text{ cm}$

w: SOH CAH TOA

$\cos 35 = \frac{w}{14}$ ×14 ×14

$w = 14\cos 35$

$= 11.468\text{ cm}$

y: $\frac{y}{\sin 45} = \frac{14}{\sin 75}$ ×sin45 ×sin45

$y = \frac{14\sin 45}{\sin 75}$

$= 10.249\text{ cm}$

z: $\frac{z}{\sin 60} = \frac{14}{\sin 75}$ ×sin60 ×sin60

$z = \frac{14\sin 60}{\sin 75}$

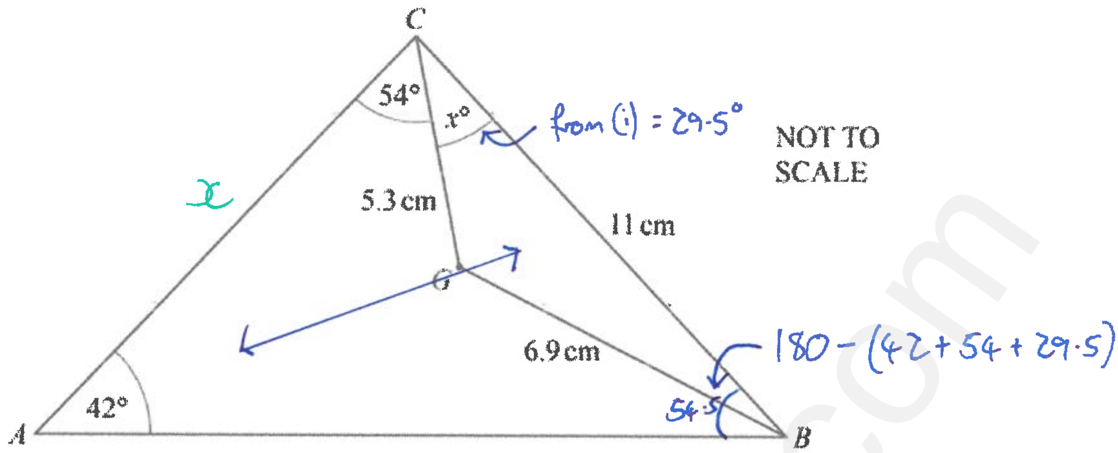
$= 12.552\text{ cm}$

Perimeter $= 8.0301 + 11.468 + 10.249 + 12.552$

$= 42.3\text{ cm}$ (3sf)

............42.3............ cm [7]

6 (a)



NOT TO SCALE

The diagram shows triangle *ABC* with point *G* inside.
CB = 11 cm, *CG* = 5.3 cm and *BG* = 6.9 cm.
Angle *CAB* = 42° and angle *ACG* = 54°.

(i) Calculate the value of *x*.

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

$6.9^2 = 5.3^2 + 11^2 - 2 \times 5.3 \times 11 \cos x$

$47.61 = 28.09 + 121 - 116.6\cos x$

$47.61 = 149.09 - 116.6\cos x$

$-149.09 \quad -149.09$

$-101.48 = -116.6\cos x$

$\div -116.6 \quad \div -116.6$

$\cos x = \dfrac{101.48}{116.6}$

$x = \cos^{-1}\left(\dfrac{101.48}{116.6}\right)$

$= 29.5°$

x = 29.5° [4]

(ii) Calculate *AC*.

x:

$\dfrac{x}{\sin 54.5} = \dfrac{11}{\sin 42}$

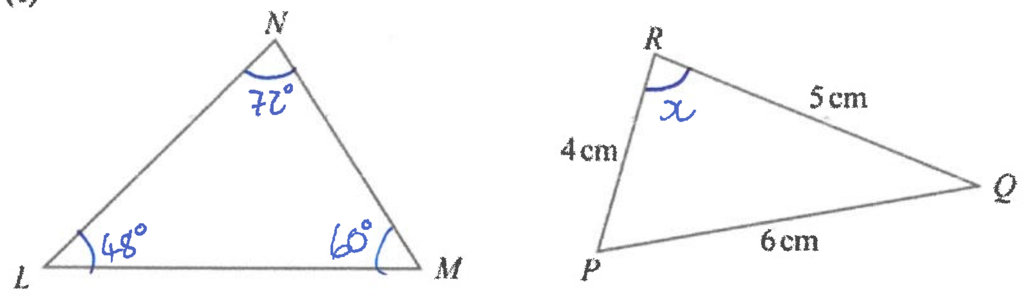
$\times \sin 54.5 \quad \times \sin 54.5$

$x = \dfrac{11\sin 54.5}{\sin 42}$

$= 13.4\text{cm}$

AC = 13.4 cm [4]

(c)



NOT TO SCALE

In triangle LMN, the ratio angle L : angle M : angle $N = 4 : 5 : 6$.
In triangle PQR, $PQ = 6$ cm, $PR = 4$ cm and $QR = 5$ cm.

Calculate the difference between the largest angle in triangle PQR and the largest angle in triangle LMN.

LMN: $4 + 5 + 6 = 15$

$180 \div 15 = 12$

$4 : 5 : 6$

$\times 12$ $\times 12$

$48 : 60 : 72$

PQR: Largest angle is opposite longest side (x):

cosine rule:

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

$6^2 = 4^2 + 5^2 - 2 \times 4 \times 5 \times \cos x$

$36 = 41 - 40\cos x$

-41 -41

$-5 = -40\cos x$

$\div -40$ $\div -40$

$\cos x = \frac{1}{8}$

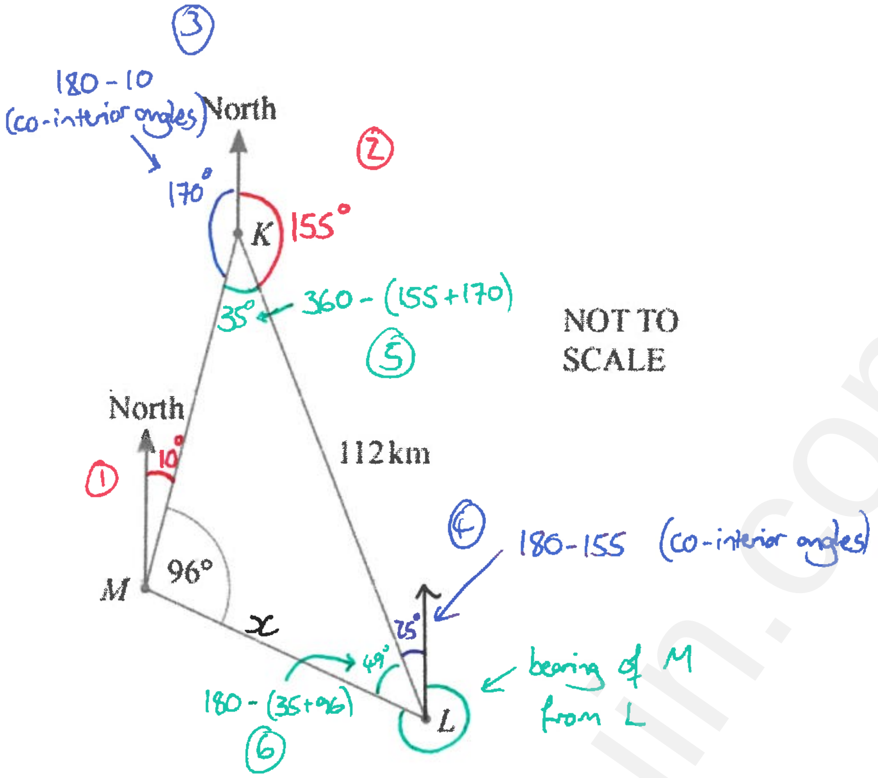
$x = \cos^{-1}\left(\frac{1}{8}\right)$

$= 82.8°$

Difference:

$82.8 - 72 = 10.8°$ ....10.8°.......... [7]

(c)



The diagram shows the positions of a lighthouse, L, and two ships, K and M.
The bearing of L from K is 155° and KL = 112 km.
The bearing of K from M is 010° and angle KML = 96°.

Find the bearing and distance of ship M from the lighthouse, L.

Bearing:

See working on diagram above (order: 1, 2, 3, 4, 5, 6)

Bearing $= 360 - (49 + 25)$

$= 286°$

Distance:

$$\frac{x}{\sin 35} = \frac{112}{\sin 96}$$

$\times \sin 35$ $\times \sin 35$

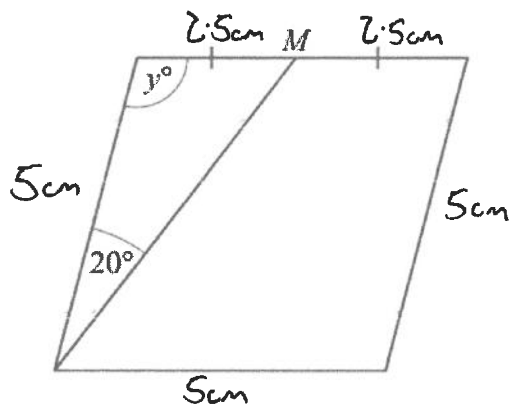
$$x = \frac{112 \sin 35}{\sin 96}$$

$= 64.6$ km

Bearing 286°

Distance 64.6 km [5]

(b)

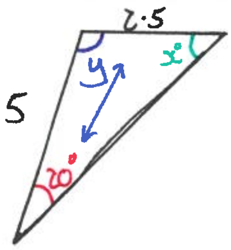


NOT TO SCALE

This rhombus has perimeter 20 cm and angle y is obtuse.
M is the midpoint of one of the sides.

each side: $\frac{20}{4} = 5\text{cm}$

Find the value of y.



x:

$$\frac{\sin x}{5} = \frac{\sin 20}{2.5} \quad \times 5 \quad \times 5$$

$$\sin x = \frac{5\sin 20}{2.5}$$

$$x = \sin^{-1}\left(\frac{5\sin 20}{2.5}\right)$$

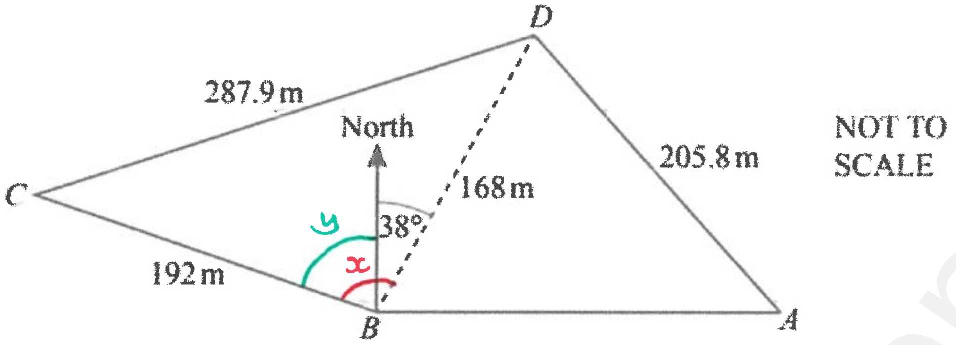
$$= \underline{43.2°}$$

y:

$$y = 180 - (20 + 43.2)$$

$$= \underline{116.8°}$$

$y =$ 116.8° [5]



The diagram shows a field, $ABCD$, on horizontal ground.
$BC = 192$ m, $CD = 287.9$ m, $BD = 168$ m and $AD = 205.8$ m.

(a) **(i)** Calculate angle CBD and show that it rounds to 106.0°, correct to 1 decimal place.

Cosine Rule:

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

$287.9^2 = 168^2 + 192^2 - 2\times168\times192\times\cos x$

$82886.41 = 65088 - 64512\cos x$

$-65088 \qquad -65088$

$17798.41 = -64512\cos x$

$\div -64512 \qquad \div -64512$

$\cos x = \frac{-17798.41}{64512}$

$x = \cos^{-1}\left(\frac{-17798.41}{64512}\right)$

$x = 106.015...$

$= 106.0$ to 1dp

[4]

(ii) The bearing of D from B is 038°.

Find the bearing of C from B.

y: $y = 106.0 - 38$

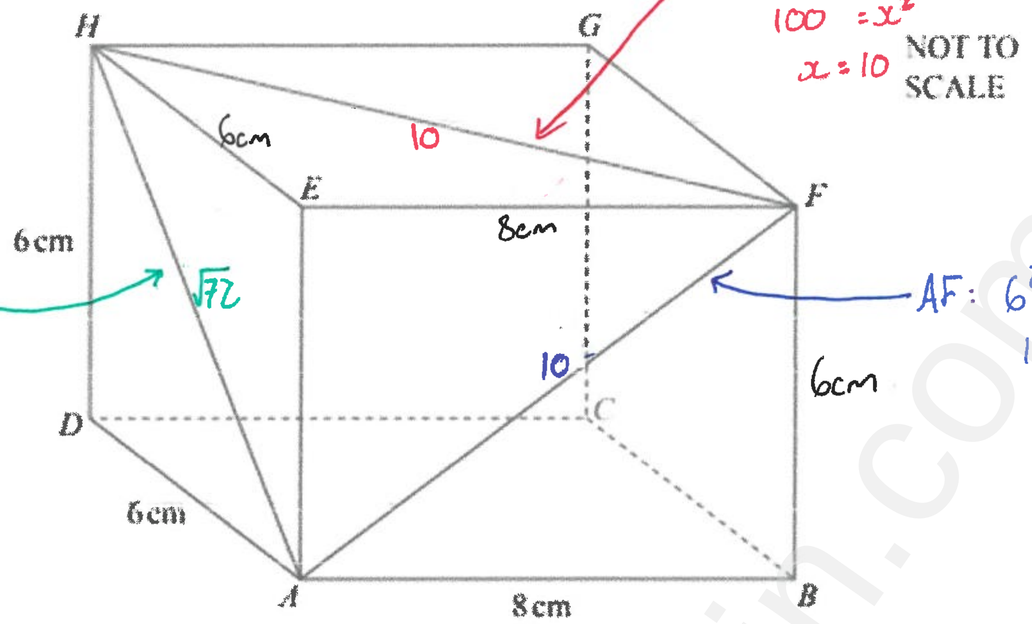
$= 68.0°$

Bearing: $360 - 68.0 = 292.0°$

..........292.0°.......... [1]

27

HF: $6^2+8^2 = x^2$
$100 = x^2$
$x = 10$

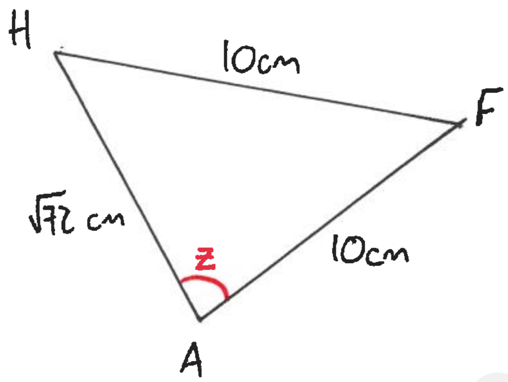


HA:
$6^2+6^2 = x^2$
$72 = x^2$
$x = \sqrt{72}$

AF: $6^2+8^2 = x^2$
$100 = x^2$
$x = 10$

The diagram shows a cuboid.
$AB = 8\text{cm}$, $AD = 6\text{cm}$ and $DH = 6\text{cm}$.

Calculate angle HAF.



Cosine Rule:

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

$10^2 = 10^2 + (\sqrt{72})^2 - 2\times 10\times\sqrt{72}\cos z$

$100 = 172 - 120\sqrt{2}\cos z$

$-172 \quad -172$

$-72 = -120\sqrt{2}\cos z$

$\div -120\sqrt{2} \quad \div -120\sqrt{2}$

$\frac{72}{120\sqrt{2}} = \cos x$

$x = \cos^{-1}\left(\frac{72}{120\sqrt{2}}\right)$

$= 64.9°$

Angle HAF = ... 64.9° .... [6]