Trigonometry and Bearing

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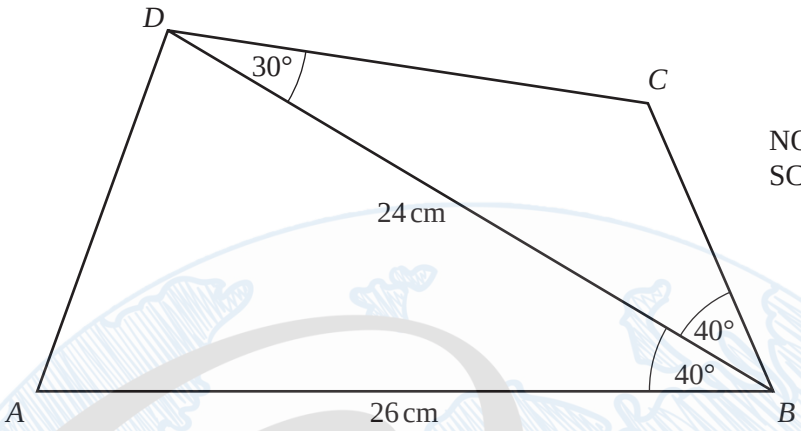

ABCD is a quadrilateral and *BD* is a diagonal.
AB = 26 cm, *BD* = 24 cm, angle *ABD* = 40°, angle *CBD* = 40° and angle *CDB* = 30°.

(a) Calculate the area of triangle *ABD*.

Answer(a) ..... cm^2 [2]

(b) Calculate the length of *AD*.

Answer(b) ..... cm [4]

(c) Calculate the length of *BC*.

Answer(c) ..... cm [4]

(d) Calculate the shortest distance from the point *C* to the line *BD*.

Answer(d) ..... cm [2]

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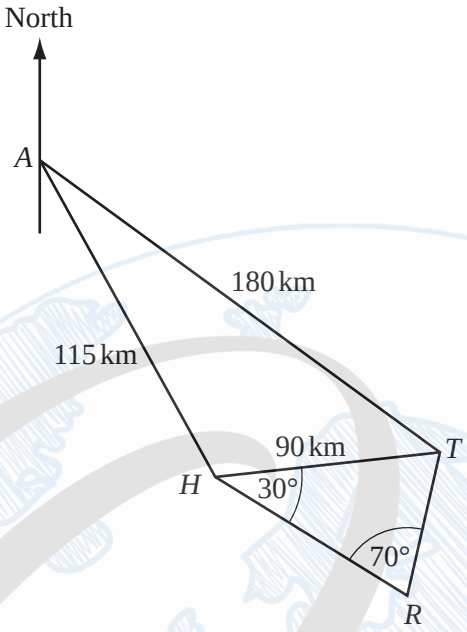


The diagram shows some straight line distances between Auckland (A), Hamilton (H), Tauranga (T) and Rotorua (R).
$AT = 180$ km, $AH = 115$ km and $HT = 90$ km.

(a) Calculate angle HAT.
Show that this rounds to 25.0°, correct to 3 significant figures.

Answer(a)

[4]

(b) The bearing of H from A is 150°.

Find the bearing of

(i) T from A,

Answer(b)(i) ..... [1]

(ii) A from T.

Answer(b)(ii) ..... [1]

(c) Calculate how far T is east of A.

Answer(c) ..... km [3]

(d) Angle $THR = 30°$ and angle $HRT = 70°$.

Calculate the distance TR.

Answer(d) ..... km [3]

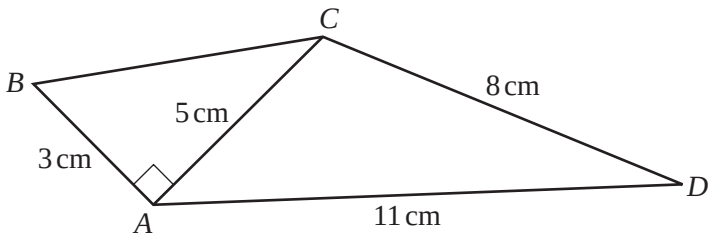
(e) On a map the distance representing HT is 4.5cm.

The scale of the map is $1 : n$.

Calculate the value of n.

Answer(e) $n =$ ..... [2]

2



NOT TO SCALE

In the quadrilateral $ABCD$, $AB = 3$ cm, $AD = 11$ cm and $DC = 8$ cm.
The diagonal $AC = 5$ cm and angle $BAC = 90°$.

Calculate

(a) the length of BC,

Answer(a) $BC =$ ..... cm [2]

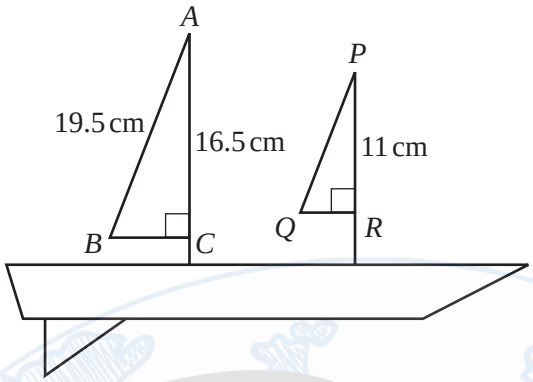
(b) angle ACD,

Answer(b) Angle $ACD =$ ..... [4]

(c) the area of the quadrilateral $ABCD$.

Answer(c) ..... cm^2 [3]

6 (a)



NOT TO SCALE

The diagram shows a toy boat.
$AC = 16.5$ cm, $AB = 19.5$ cm and $PR = 11$ cm.
Triangles ABC and PQR are **similar**.

(i) Calculate PQ.

Answer(a)(i) $PQ =$ ..... cm [2]

(ii) Calculate BC.

Answer(a)(ii) $BC =$ ..... cm [3]

(iii) Calculate angle ABC.

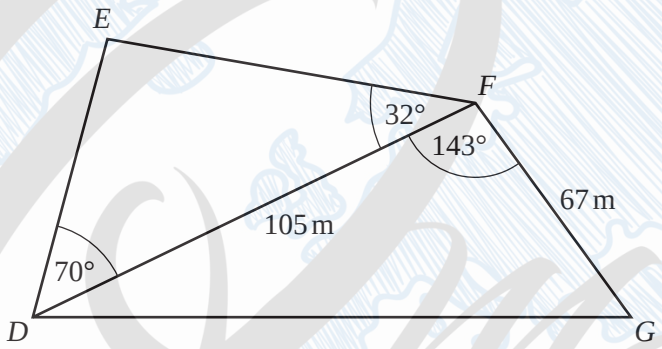
Answer(a)(iii) Angle $ABC =$ ..... [2]

(iv) The toy boat is mathematically similar to a real boat.
The length of the real boat is 32 times the length of the toy boat.
The fuel tank in the toy boat holds 0.02 litres of diesel.

Calculate how many litres of diesel the fuel tank of the real boat holds.

Answer(a)(iv) ..... litres [2]

(b)



The diagram shows a field *DEFG*, in the shape of a quadrilateral, with a footpath along the diagonal *DF*.
DF = 105 m and *FG* = 67 m.
Angle *EDF* = 70°, angle *EFD* = 32° and angle *DFG* = 143°.

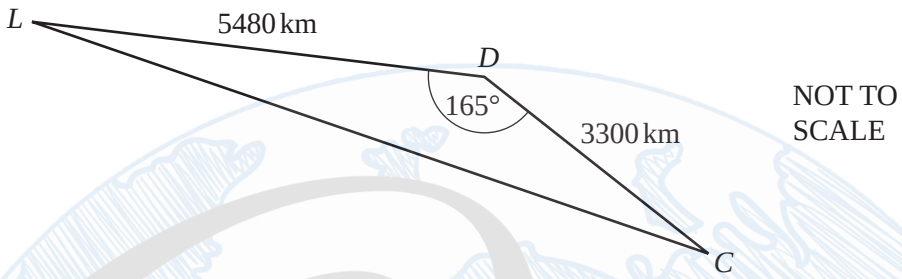
(i) Calculate *DG*.

Answer(b)(i) *DG* = ... m [4]

(ii) Calculate *EF*.

Answer(b)(ii) *EF* = ... m [4]

6



The diagram shows the positions of London (L), Dubai (D) and Colombo (C).

(a) (i) Show that LC is 8710 km correct to the nearest kilometre.

Answer(a)(i)

[4]

(ii) Calculate the angle CLD.

Answer(a)(ii) Angle CLD = ... [3]

(b) A plane flies from London to Dubai and then to Colombo.
It leaves London at 01 50 and the total journey takes 13 hours and 45 minutes.
The local time in Colombo is 7 hours ahead of London.
Find the arrival time in Colombo.

Answer(b) ..... [2]

(c) Another plane flies the 8710 km directly from London to Colombo at an average speed of 800 km/h.
How much longer did the plane in **part (b)** take to travel from London to Colombo?
Give your answer in hours and minutes, correct to the nearest minute.

Answer(c) ..... h ..... min [4]

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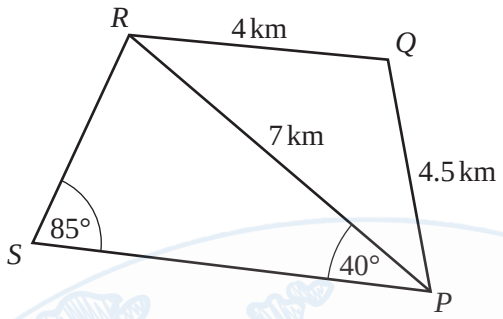


NOT TO SCALE

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.

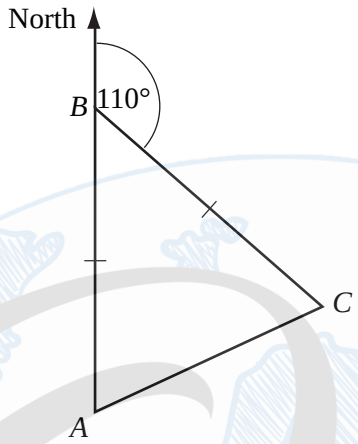
Answer(b)

[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]

1 **(b)** The route for the **sponsored walk in winter** is triangular.



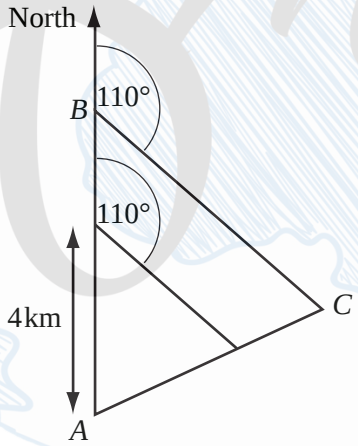
NOT TO SCALE

(i) Senior students start at A, walk North to B, then walk on a bearing 110° to C. They then return to A.
$AB = BC$.

Calculate the bearing of A from C.

Answer(b)(i) ..... [3]

(ii)



NOT TO SCALE

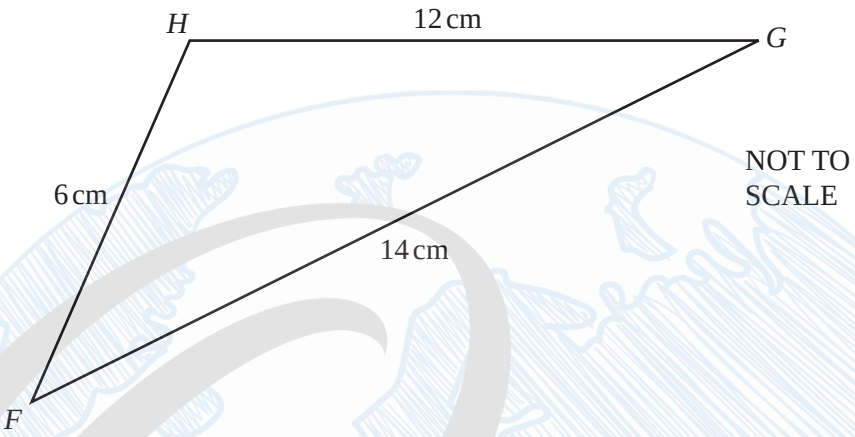
$AB = BC = 6$ km.
Junior students follow a **similar** path but they only walk 4 km North from A, then 4km on a bearing 110° before returning to A.

Senior students walk a total of 18.9 km.

Calculate the distance walked by junior students.

Answer(b)(ii) ..... km [3]

4 (a)



The diagram shows triangle *FGH*, with $FG = 14$ cm, $GH = 12$ cm and $FH = 6$ cm.

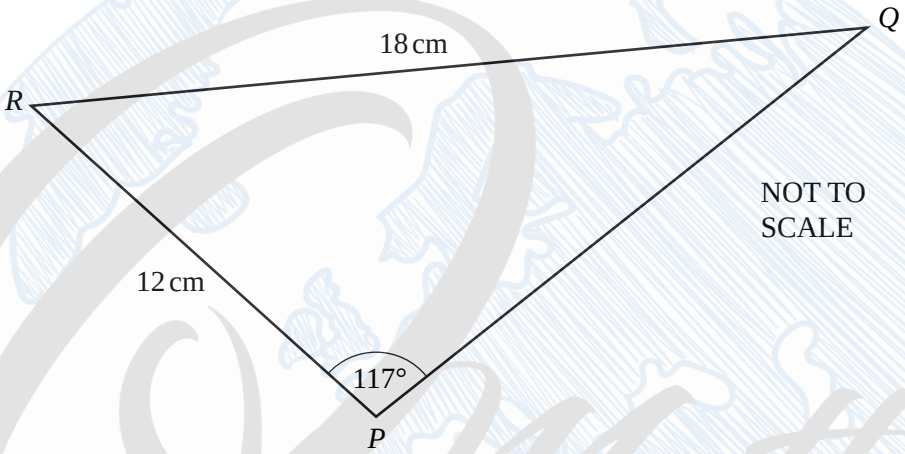
(i) Calculate the size of angle *HFG*.

Answer(a)(i) Angle *HFG* = ... [4]

(ii) Calculate the area of triangle *FGH*.

Answer(a)(ii) ..... cm^2 [2]

(b)



The diagram shows triangle PQR, with $RP = 12$ cm, $RQ = 18$ cm and angle $RPQ = 117°$.

Calculate the size of angle RQP.

Answer(b) Angle RQP = ... [3]

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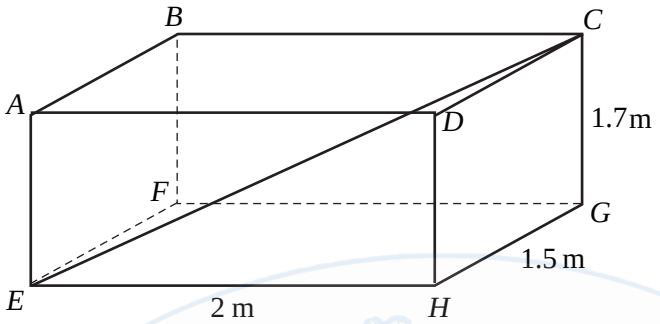


NOT TO SCALE

The diagram shows a box *ABCDEFGH* in the shape of a cuboid measuring 2 m by 1.5 m by 1.7 m.

(a) Calculate the length of the diagonal *EC*

Answer(a) EC = ... m [4]

(b) Calculate the angle between *EC* and the base *EFGH*.

Answer(b) ..... [3]

(c) **(i)** A rod has length 2.9 m, correct to 1 decimal place.

What is the upper bound for the length of the rod?

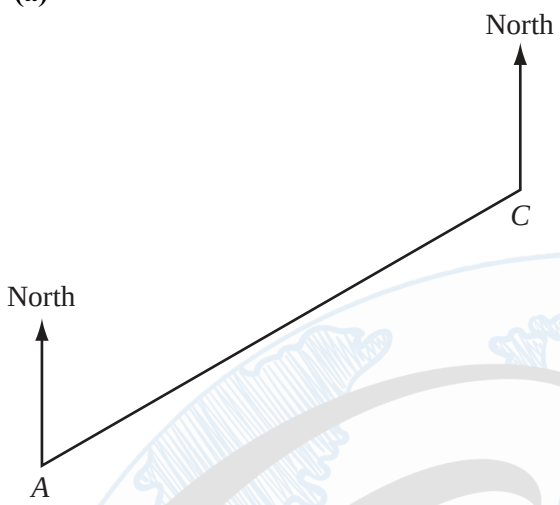
Answer(c)(i) ..... m [1]

(ii) Will the rod fit completely in the box?

Give a reason for your answer.

Answer(c)(ii) ..... [1]

3 (a)



The scale drawing shows the positions of two towns *A* and *C* on a map.
On the map, 1 centimetre represents 20 kilometres.

(i) Find the distance in kilometres from town *A* to town *C*.

Answer(a)(i) ..... km [2]

(ii) Measure and write down the bearing of town *C* from town *A*.

Answer(a)(ii) ..... [1]

(iii) Town *B* is 140 km from town *C* on a bearing of 150°.

Mark accurately the position of town *B* on the scale drawing. [2]

(iv) Find the bearing of town *C* from town *B*.

Answer(a)(iv) ..... [1]

(v) A lake on the map has an area of 0.15 cm^2.

Work out the actual area of the lake.

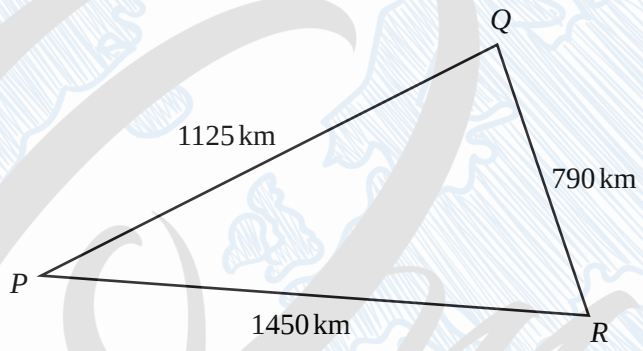
Answer(a)(v) ..... km^2 [2]

(b) A plane leaves town C at 11 57 and flies 1500 km to another town, landing at 14 12.

Calculate the average speed of the plane.

Answer(b) ..... km/h [3]

(c)

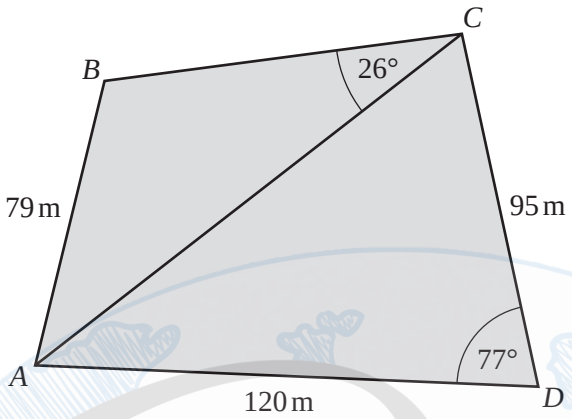


The diagram shows the distances between three towns P, Q and R.

Calculate angle PQR.

Answer(c) Angle PQR = ... [4]

6



The quadrilateral *ABCD* represents an area of land.
There is a straight road from *A* to *C*.
AB = 79 m, *AD* = 120 m and *CD* = 95 m.
Angle *BCA* = 26° and angle *CDA* = 77°.

(a) Show that the length of the road, *AC*, is 135 m correct to the nearest metre.

Answer(a)

[4]

(b) Calculate the size of the **obtuse** angle *ABC*.

Answer(b) Angle *ABC* = ... [4]

(c) A straight path is to be built from B to the nearest point on the road AC.

Calculate the length of this path.

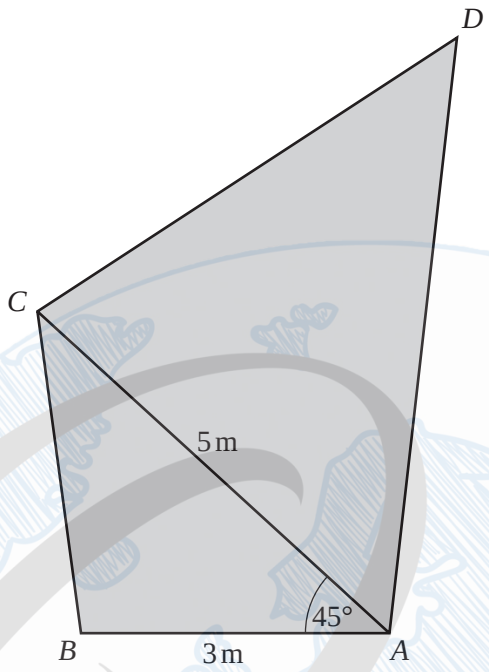
Answer(c) ..... m [3]

(d) Houses are to be built on the land in triangle ACD.
Each house needs at least $180\,m^2$ of land.

Calculate the maximum number of houses which can be built.
Show all of your working.

Answer(d) ..... [4]

8



NOT TO SCALE

Parvatti has a piece of canvas *ABCD* in the shape of an irregular quadrilateral.

AB = 3 m, *AC* = 5 m and angle *BAC* = 45°.

(a) **(i)** Calculate the length of *BC* and show that it rounds to 3.58 m, correct to 2 decimal places.

You must show all your working.

Answer(a)(i)

[4]

(ii) Calculate angle *BCA*.

Answer(a)(ii) Angle *BCA* = ... [3]

(b) $AC = CD$ and angle $CDA = 52°$.

(i) Find angle DCA.

Answer(b)(i) Angle DCA = ... [1]

(ii) Calculate the area of the canvas.

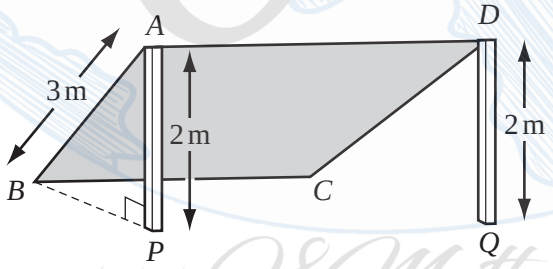
Answer(b)(ii) ..... m^2 [3]

(c) Parvatti uses the canvas to give some shade.

She attaches corners A and D to the top of vertical poles, AP and DQ, each of height 2 m.

Corners B and C are pegged to the horizontal ground.

AB is a straight line and angle $BPA = 90°$.

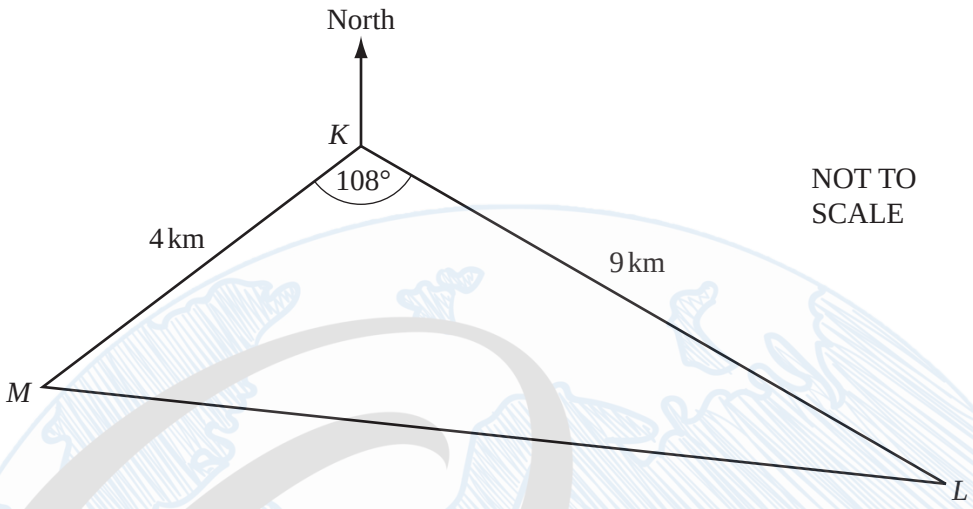


NOT TO SCALE

Calculate angle PAB.

Answer(c) Angle PAB = ... [2]

2



NOT TO SCALE

Three buoys K, L and M show the course of a boat race.
$MK = 4$ km, $KL = 9$ km and angle $MKL = 108°$.

(a) Calculate the distance ML.

Answer(a) $ML =$ ..... km [4]

(b) The bearing of L from K is 125°.

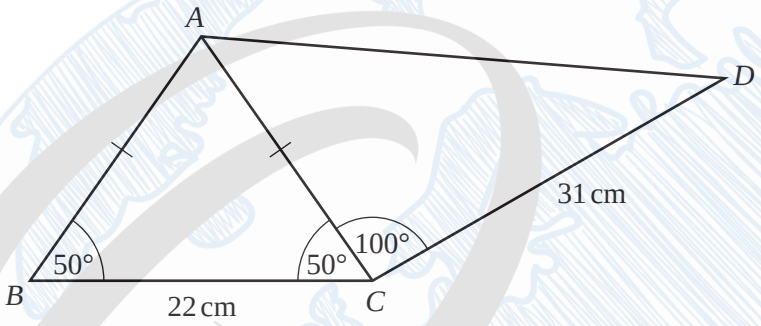
(i) Calculate how far L is south of K.

Answer(b)(i) ..... km [3]

(ii) Find the three figure bearing of K from M.

Answer(b)(ii) ..... [2]

11 **(c)**

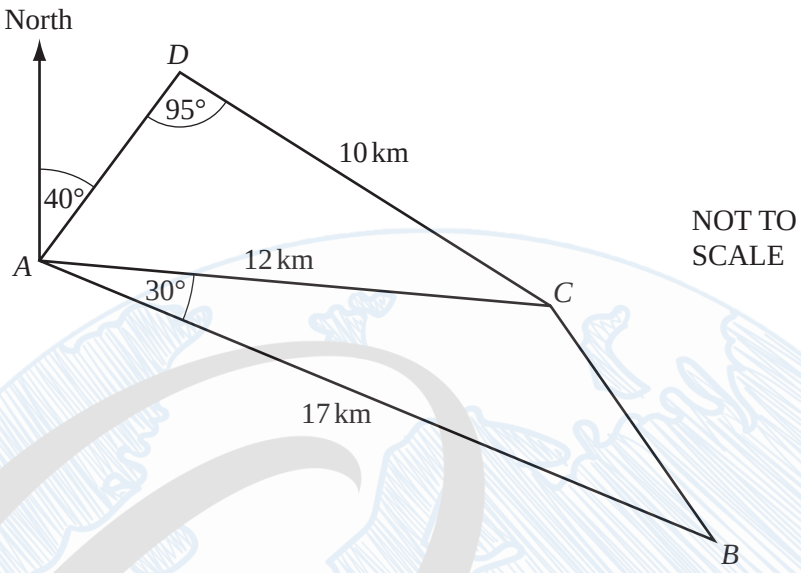


The frame of a child's bicycle is made from metal rods.
ABC is an isosceles triangle with base 22 cm and base angles 50°.
Angle *ACD* = 100° and *CD* = 31 cm.

Calculate the length *AD*.

Answer(c) AD = ... cm [6]

2



The diagram shows straight roads connecting the towns A, B, C and D.

$AB = 17$ km, $AC = 12$ km and $CD = 10$ km.

Angle $BAC = 30°$ and angle $ADC = 95°$.

(a) Calculate angle CAD.

Answer(a) Angle CAD = ... [3]

(b) Calculate the distance BC.

Answer(b) BC = ... km [4]

(c) The bearing of D from A is 040°.

Find the bearing of

(i) B from A,

Answer(c)(i) ..... [1]

(ii) A from B.

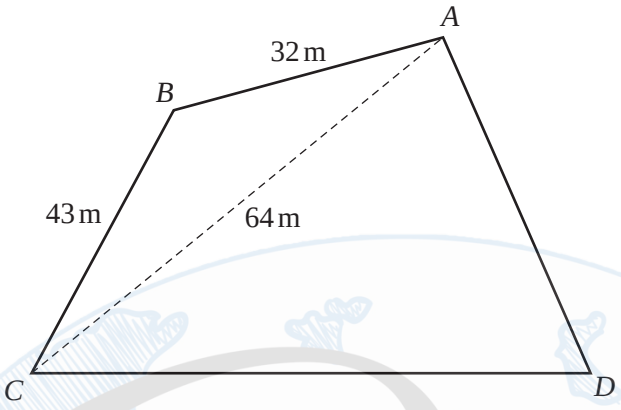
Answer(c)(ii) ..... [1]

(d) Angle ACB is obtuse.

Calculate angle BCD.

Answer(d) Angle BCD = ... [4]

2



NOT TO SCALE

The diagram represents a field in the shape of a quadrilateral *ABCD*.
AB = 32 m, *BC* = 43 m and *AC* = 64 m.

(a) **(i)** Show clearly that angle *CAB* = 37.0° correct to one decimal place.

Answer(a)(i)

[4]

(ii) Calculate the area of the triangle *ABC*.

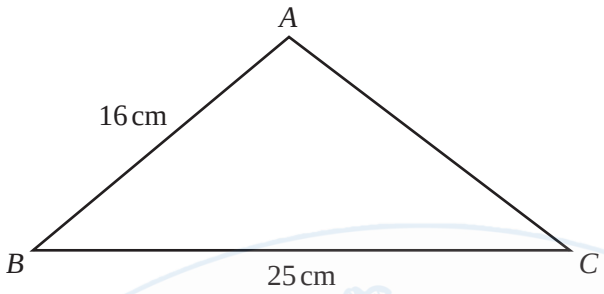
Answer(a)(ii) ..... m^2 [2]

(b) *CD* = 70 m and angle *DAC* = 55°.

Calculate the perimeter of the whole field *ABCD*.

Answer(b) ..... m [6]

6



NOT TO SCALE

The area of triangle ABC is $130\,cm^2$.
$AB = 16\,cm$ and $BC = 25\,cm$.

(a) Show clearly that angle $ABC = 40.5°$, correct to one decimal place.

Answer (a)

[3]

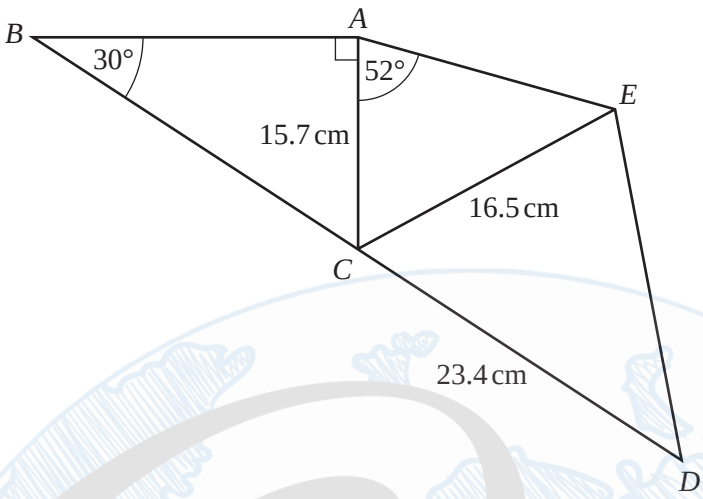
(b) Calculate the length of AC.

Answer(b) $AC =$ ..... cm [4]

(c) Calculate the shortest distance from A to BC.

Answer(c) ..... cm [2]

6



NOT TO SCALE

In the diagram, *BCD* is a straight line and *ABDE* is a quadrilateral.
Angle *BAC* = 90°, angle *ABC* = 30° and angle *CAE* = 52°.
AC = 15.7 cm, *CE* = 16.5 cm and *CD* = 23.4 cm.

(a) Calculate *BC*.

Answer(a) BC = ... cm [3]

(b) Use the sine rule to calculate angle *AEC*.
Show that it rounds to 48.57°, correct to 2 decimal places.

Answer(b)

[3]

(c) **(i)** Show that angle $ECD = 40.6°$, correct to 1 decimal place.

Answer(c)(i)

[2]

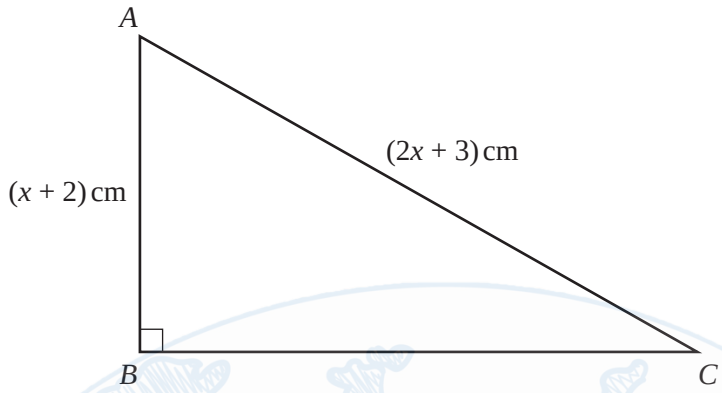
(ii) Calculate DE.

Answer(c)(ii) DE = ... cm [4]

(d) Calculate the area of the quadrilateral $ABDE$.

Answer(d) ..... cm^2 [4]

7 **(a)**



NOT TO SCALE

In triangle ABC, $AB = (x + 2)$ cm and $AC = (2x + 3)$ cm.

$\sin ACB = \frac{9}{16}$

Find the length of BC.

Answer(a) $BC =$ ..... cm [6]

(b) A bag contains 7 white beads and 5 red beads.

(i) The mass of a red bead is 2.5 grams more than the mass of a white bead.
The total mass of all the 12 beads is 114.5 grams.

Find the mass of a white bead and the mass of a red bead.

Answer(b)(i) White ..... g

Red ..... g [5]

(ii) Two beads are taken out of the bag at random, without replacement.

Find the probability that

(a) they are both white,

Answer(b)(ii)(a) ..... [2]

(b) one is white and one is red.

Answer(b)(ii)(b) ..... [3]

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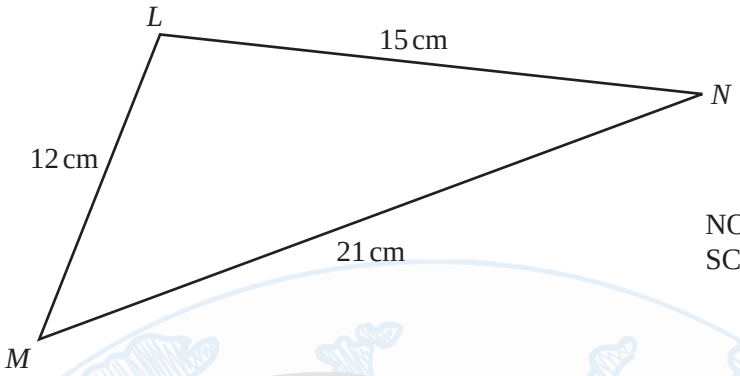
6 (a)



NOT TO SCALE

The diagram shows triangle *LMN* with $LM = 12$ cm, $LN = 15$ cm and $MN = 21$ cm.

(i) Calculate angle *LMN*.
Show that this rounds to 44.4°, correct to 1 decimal place.

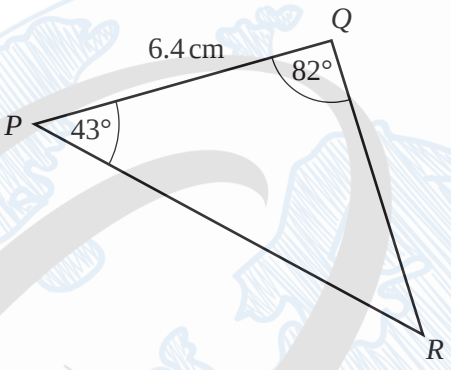
Answer(a)(i)

[4]

(ii) Calculate the area of triangle *LMN*.

Answer(a)(ii) ..... cm^2 [2]

(b)



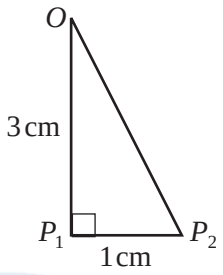
NOT TO SCALE

The diagram shows triangle PQR with $PQ = 6.4$ cm, angle $PQR = 82°$ and angle $QPR = 43°$.

Calculate the length of PR.

Answer(b) PR = ... cm [4]

11 Sidney draws the triangle OP_1P_2.
$OP_1 = 3\,\text{cm}$ and $P_1P_2 = 1\,\text{cm}$.
Angle $OP_1P_2 = 90°$.



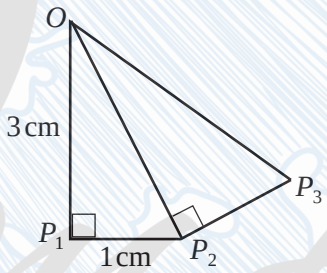
NOT TO SCALE

(a) Show that $OP_2 = \sqrt{10}\,\text{cm}$.

Answer(a)

[1]

(b) Sidney now draws the lines P_2P_3 and OP_3
Triangle OP_2P_3 is mathematically similar to triangle OP_1P_2



NOT TO SCALE

(i) Write down the length of P_2P_3 in the form $\frac{\sqrt{a}}{b}$ where a and b are integers.

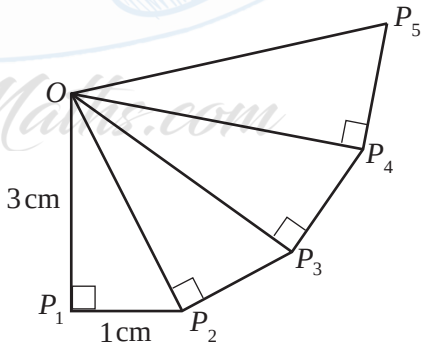
Answer(b)(i) P_2P_3 = ... cm [1]

(ii) Calculate the length of OP_3 giving your answer in the form $\frac{c}{d}$ where c and d are integers.

Answer(b)(ii) OP_3 = ... cm [2]

(c) Sidney continues to add mathematically similar triangles to his drawing.

Find the length of OP_5.



NOT TO SCALE

Answer(c) OP = ... cm [2]

(d) **(i)** Show that angle $P_1OP_2 = 18.4°$, correct to 1 decimal place.

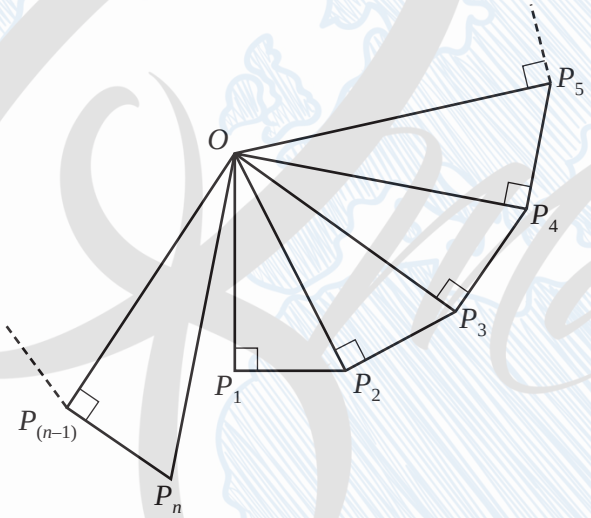
Answer(d)(i)

[2]

(ii) Write down the size of angle P_2OP_3.

Answer(d)(ii) Angle P_2OP_3 = ... [1]

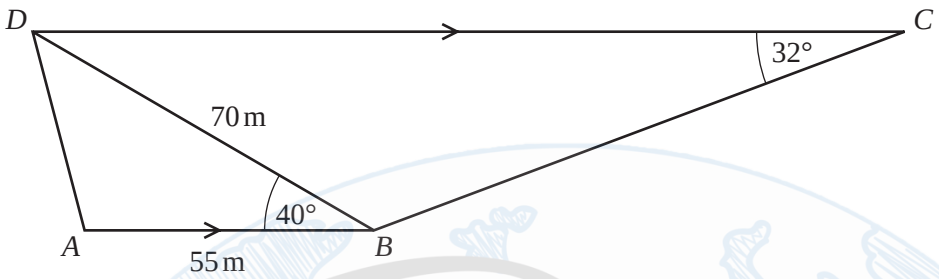
(iii) The last triangle Sidney can draw without covering his first triangle is triangle $OP_{(n-1)}P_n$.



Calculate the value of n.

Answer(d)(iii) n = ... [3]

4



NOT TO SCALE

The diagram shows a school playground *ABCD*.
ABCD is a trapezium.
AB = 55 m, *BD* = 70 m, angle *ABD* = 40° and angle *BCD* = 32°.

(a) Calculate *AD*.

Answer(a) AD = ... m [4]

(b) Calculate *BC*.

Answer(b) BC = ... m [4]

(c) **(i)** Calculate the area of the playground *ABCD*.

Answer(c)(i) ..... m^2 [3]

(ii) An accurate plan of the school playground is to be drawn to a scale of 1:200 .

Calculate the area of the school playground on the plan.
Give your answer in cm^2.

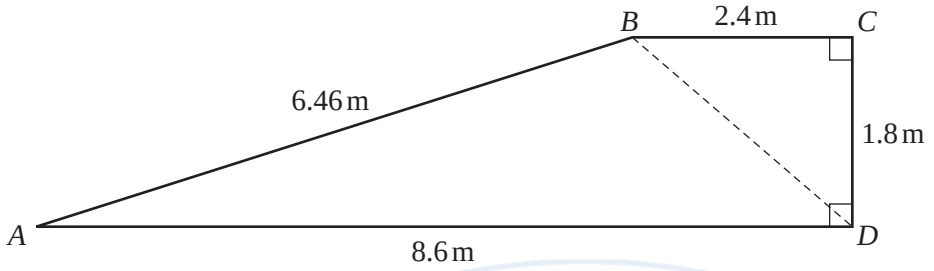
Answer(c)(ii) ..... cm^2 [2]

(d) A fence, *BD*, divides the playground into two areas.

Calculate the shortest distance from *A* to *BD*.

Answer(d) ..... m [2]

2



NOT TO SCALE

The diagram shows the cross section, *ABCD*, of a ramp.

(a) Calculate angle *DBC*.

Answer(a) Angle *DBC* = ... [2]

(b) **(i)** Show that *BD* is exactly 3 m.

Answer(b)(i)

[2]

(ii) Use the cosine rule to calculate angle *ABD*.

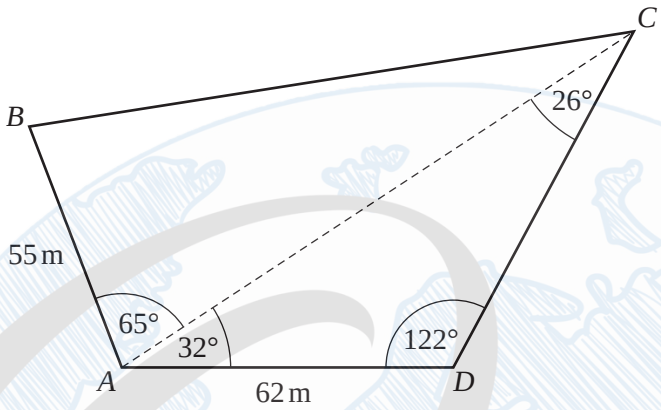
Answer(b)(ii) Angle *ABD* = ... [4]

(c) The ramp is a prism of width 4 m.

Calculate the volume of this prism.

Answer(c) ..... m^3 [3]

2 A field, *ABCD*, is in the shape of a quadrilateral.
A footpath crosses the field from *A* to *C*.



(a) Use the sine rule to calculate the distance *AC* and show that it rounds to 119.9 m, correct to 1 decimal place.

Answer(a)

[3]

(b) Calculate the length of *BC*.

Answer(b) BC = ... m [4]

(c) Calculate the area of triangle *ACD*.

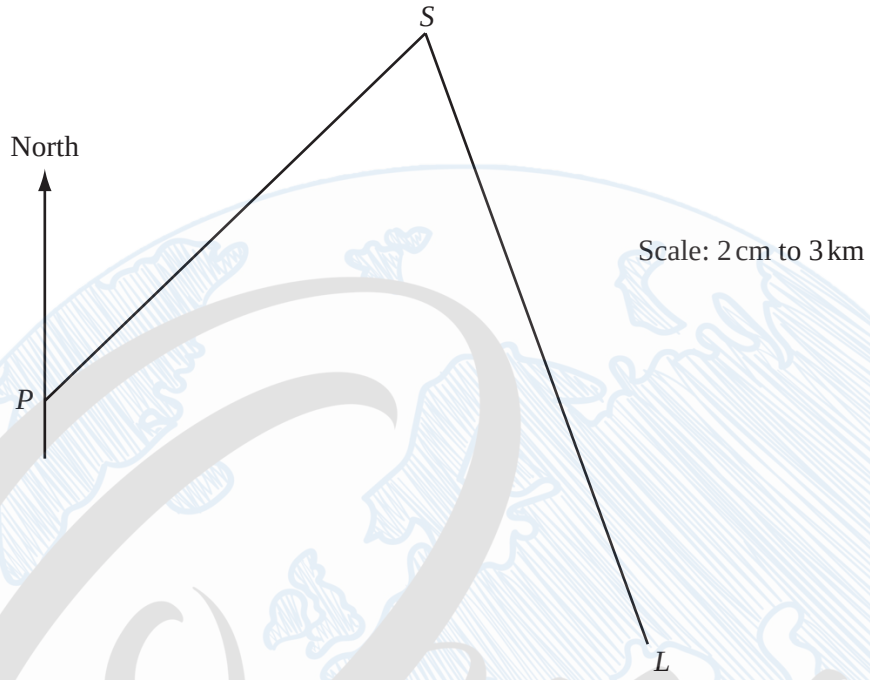
Answer(c) ..... m^2 [2]

(d) The field is for sale at \$4.50 per square metre.

Calculate the cost of the field.

Answer(d) \$ ..... [3]

5



In the scale drawing, P is a port, L is a lighthouse and S is a ship.
The scale is 2 centimetres represents 3 kilometres.

(a) Measure the bearing of S from P.

Answer(a) ..... [1]

(b) Find the actual distance of S from L.

Answer(b) ..... km [2]

(c) The bearing of L from S is 160°.

Calculate the bearing of S from L.

Answer(c) ..... [1]

(d) Work out the scale of the map in the form $1 : n$.

Answer(d) $1 :$ ..... [2]

(e) A boat B is

- equidistant from S and L

and

- equidistant from the lines PS and SL.

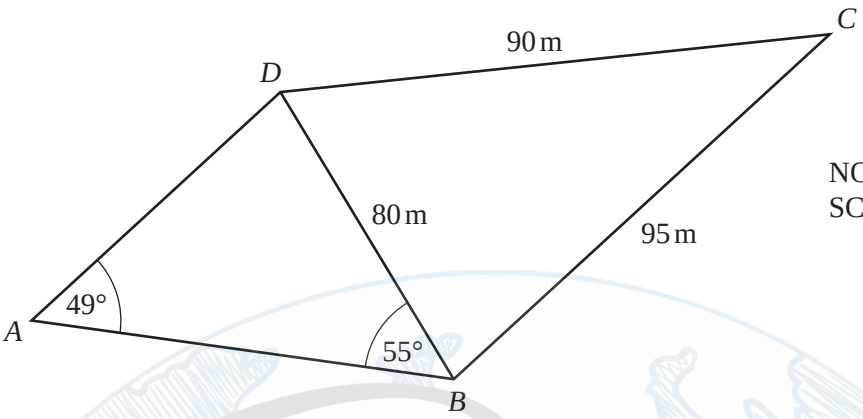
On the diagram, **using a straight edge and compasses only**, construct the position of B. [5]

(f) The lighthouse stands on an island of area $1.5\,cm^2$ on the scale drawing.

Work out the actual area of the island.

Answer(f) ..... km^2 [2]

3



NOT TO SCALE

The diagram shows a quadrilateral *ABCD*.
Angle *BAD* = 49° and angle *ABD* = 55°.
BD = 80 m, *BC* = 95 m and *CD* = 90 m.

(a) Use the sine rule to calculate the length of *AD*.

Answer(a) AD = ... m [3]

(b) Use the cosine rule to calculate angle *BCD*.

Answer(b) Angle *BCD* = ... [4]

(c) Calculate the area of the quadrilateral *ABCD*.

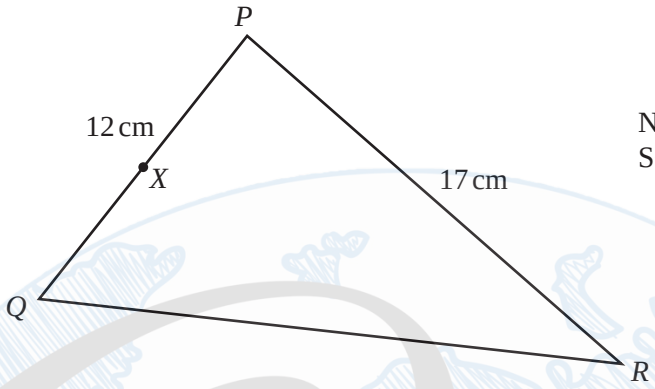
Answer(c) ..... m^2 [3]

(d) The quadrilateral represents a field.
Corn seeds are sown across the whole field at a cost of $3250 per hectare.

Calculate the cost of the corn seeds used.
1 hectare = 10 000 m^2

Answer(d) $ ..... [3]

3 (a)



The diagram shows triangle PQR with $PQ = 12$ cm and $PR = 17$ cm.
The area of triangle PQR is 97 cm^2 and angle QPR is acute.

(i) Calculate angle QPR.

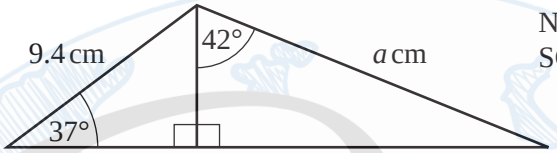
Answer(a)(i) Angle QPR = ... [3]

(ii) The midpoint of PQ is X.

Use the cosine rule to calculate the length of XR.

Answer(a)(ii) XR = ... cm [4]

(b)



Calculate the value of a.

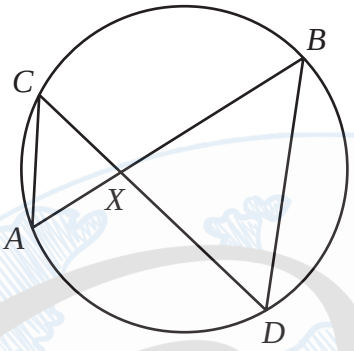
Answer(b) a = ... [4]

(c) $\sin x = \cos 40°, \quad 0° \leqslant x \leqslant 180°$

Find the two values of x.

Answer(c) x = ... or x = ... [2]

7 **(a)** The diagram shows a circle with two chords, *AB* and *CD*, intersecting at *X*.



NOT TO SCALE

(i) Show that triangles *ACX* and *DBX* are similar.

Answer(a)(i)

[2]

(ii) $AX = 3.2\,\text{cm}$, $BX = 12.5\,\text{cm}$, $CX = 4\,\text{cm}$ and angle $AXC = 110°$.

(a) Find *DX*.

Answer(a)(ii)(a) *DX* = ... cm [2]

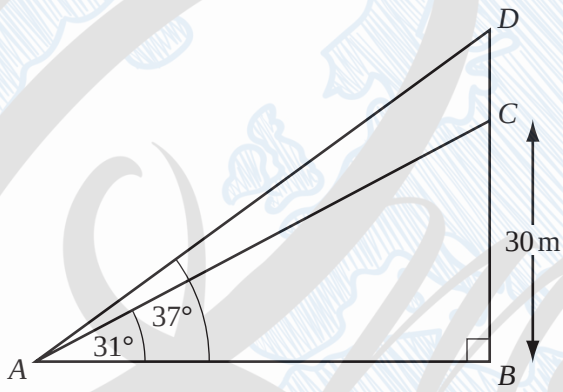
(b) Use the cosine rule to find *AC*.

Answer(a)(ii)(b) *AC* = ... cm [4]

(c) Find the area of triangle *BXD*.

Answer(a)(ii)(c) ..... cm^2 [2]

(b)



NOT TO SCALE

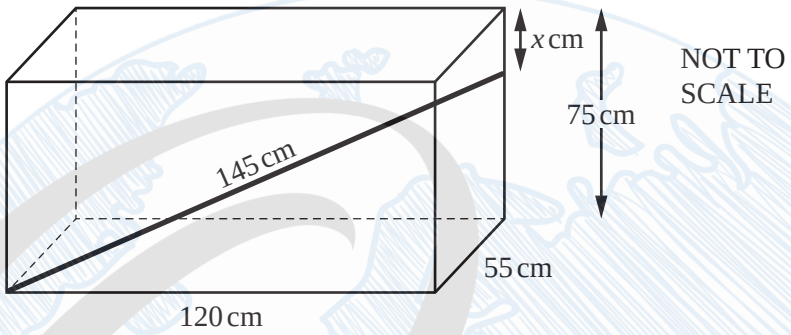
In the diagram, *BC* represents a building 30 m tall.
A flagpole, *DC*, stands on top of the building.
From a point, *A*, the angle of elevation of the top of the building is 31°.
The angle of elevation of the top of the flagpole is 37°.

Calculate the height, *DC*, of the flagpole.

Answer(b) ..... m [5]

7

(c)



A rod of length 145 cm is placed inside the water tank.
One end of the rod is in the bottom corner of the tank as shown.
The other end of the rod is x cm below the top corner of the tank as shown.

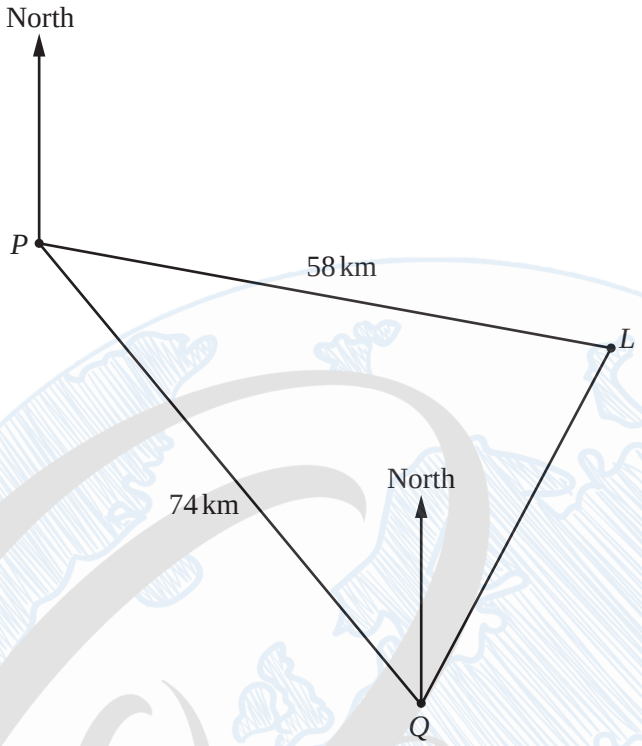
Calculate the value of x.

Answer(c) x = ... [4]

(d) Calculate the angle that the rod makes with the base of the tank.

Answer(d) ..... [3]

8



A ship sails from port *P* to port *Q*.
Q is 74 km from *P* on a bearing of 142°.
A lighthouse, *L*, is 58 km from *P* on a bearing of 110°.

(a) Show that the distance *LQ* is 39.5 km correct to 1 decimal place.

Answer(a)

[5]

(b) Use the sine rule to calculate angle *PQL*.

Answer(b) Angle *PQL* = ... [3]

(c) Find the bearing of

(i) *P* from *Q*,

Answer(c)(i) ..... [2]

(ii) *L* from *Q*.

Answer(c)(ii) ..... [1]

(d) The ship takes 2 hours and 15 minutes to sail the 74 km from *P* to *Q*.

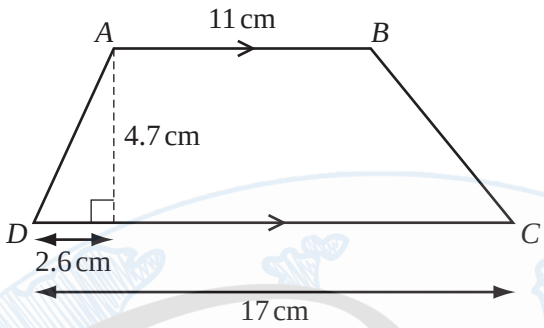
Calculate the average speed in knots.
[1 knot = 1.85 km/h]

Answer(d) ..... knots [3]

(e) Calculate the shortest distance from the lighthouse to the path of the ship.

Answer(e) ..... km [3]

1 **(a)** *ABCD* is a trapezium.



NOT TO SCALE

(i) Calculate the length of *AD*.

Answer(a)(i) *AD* = ... cm [2]

(ii) Calculate the size of angle *BCD*.

Answer(a)(ii) Angle *BCD* = ... [3]

(iii) Calculate the area of the trapezium *ABCD*.

Answer(a)(iii) ..... cm^2 [2]

(b) A **similar** trapezium has perpendicular height 9.4 cm.

Calculate the area of this trapezium.

Answer(b) ..... cm^2 [3]

5 **(a)** Andrei stands on level horizontal ground, 294 m from the foot of a vertical tower which is 55 m high.

(i) Calculate the angle of elevation of the top of the tower.

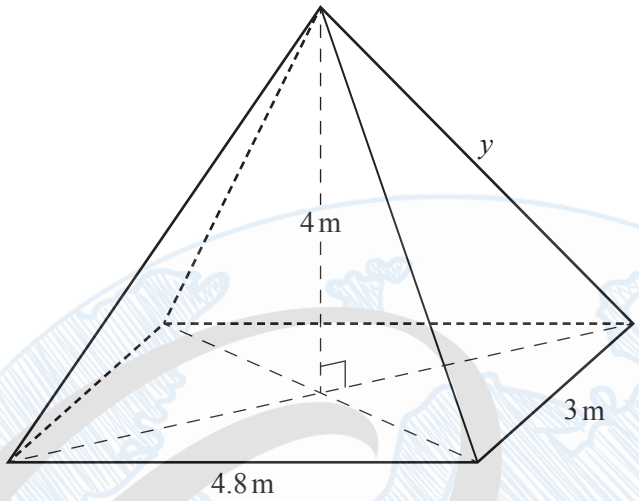
Answer(a)(i) ..... [2]

(ii) Andrei walks a distance x metres directly towards the tower.
The angle of elevation of the top of the tower is now 24.8°.

Calculate the value of x.

Answer(a)(ii) x = ... [4]

(b) The diagram shows a pyramid with a horizontal rectangular base.



NOT TO SCALE

The rectangular base has length 4.8 m and width 3 m and the height of the pyramid is 4 m.

Calculate

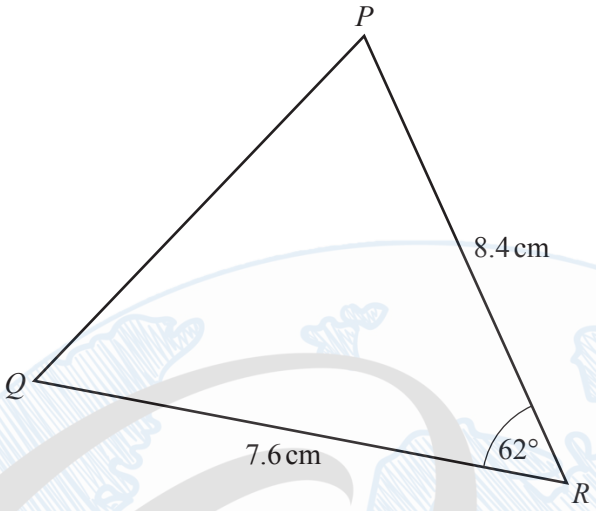
(i) y, the length of a sloping edge of the pyramid,

Answer(b)(i) y = ... m [4]

(ii) the angle between a sloping edge and the rectangular base of the pyramid.

Answer(b)(ii) ..... [2]

7 (a)



NOT TO SCALE

In the triangle PQR, $QR = 7.6$ cm and $PR = 8.4$ cm.
Angle $QRP = 62°$.

Calculate

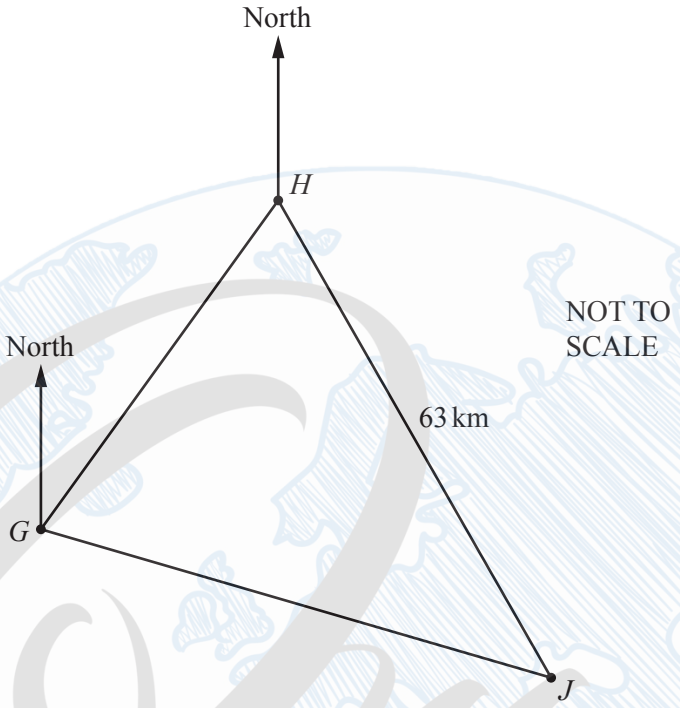
(i) PQ,

Answer(a)(i) PQ = ... cm [4]

(ii) the area of triangle PQR.

Answer(a)(ii) ..... cm^2 [2]

(b)

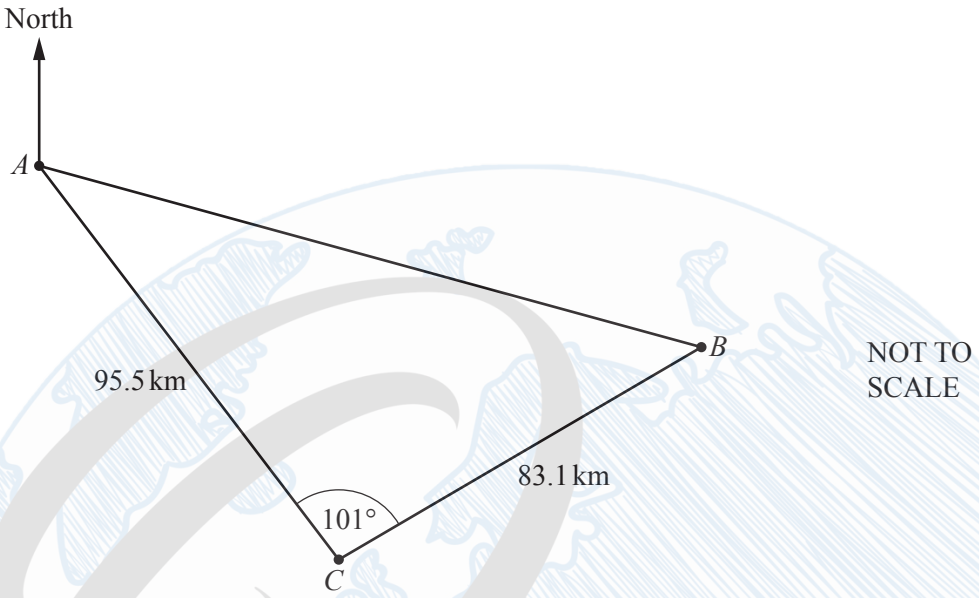


The diagram shows the positions of three small islands G, H and J.
The bearing of H from G is 045°.
The bearing of J from G is 126°.
The bearing of J from H is 164°.
The distance HJ is 63 km.

Calculate the distance GJ.

Answer(b) $GJ =$ ..... km [5]

6 The diagram shows the positions of two ships, A and B, and a coastguard station, C.



(a) Calculate the distance, AB, between the two ships.
Show that it rounds to 138 km, correct to the nearest kilometre.

Answer(a)

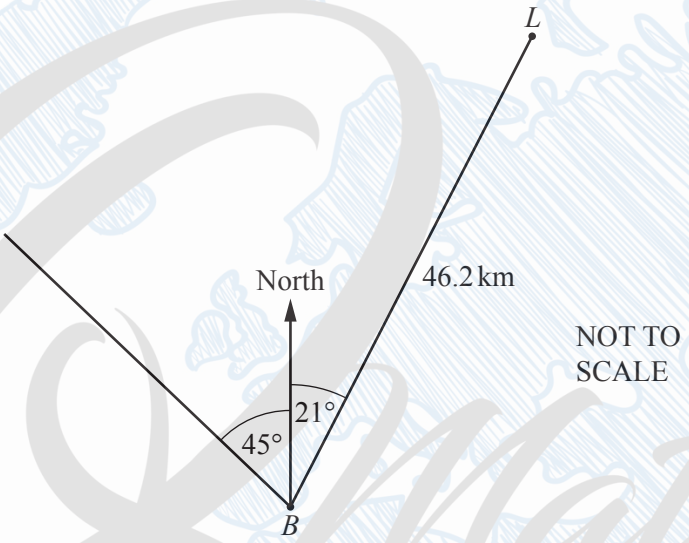
[4]

(b) The bearing of the coastguard station C from ship A is 146°.

Calculate the bearing of ship B from ship A.

Answer(b) ..... [4]

(c)

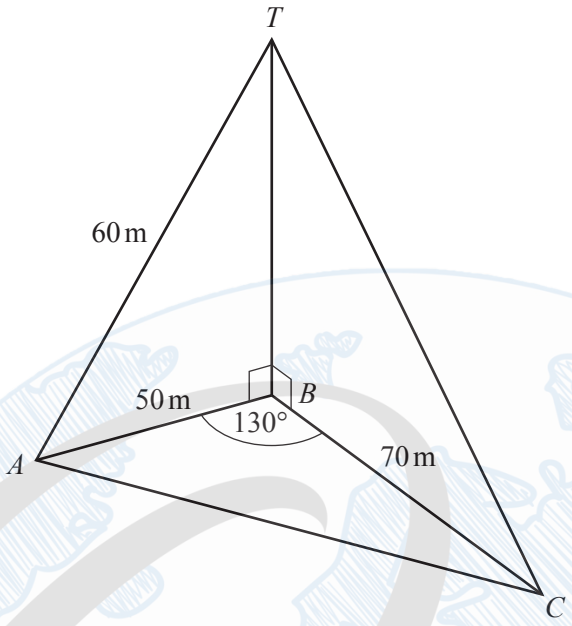


At noon, a lighthouse, L, is 46.2 km from ship B on the bearing 021°.
Ship B sails north west.

Calculate the distance ship B must sail from its position at noon to be at its closest distance to the lighthouse.

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

3 (a)



A, B and C are points on horizontal ground.
BT is a vertical pole.
$AT = 60$ m, $AB = 50$ m, $BC = 70$ m and angle $ABC = 130°$.

(i) Calculate the angle of elevation of T from C.

Answer(a)(i) ..... [5]

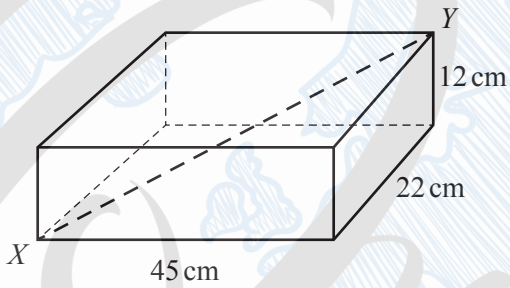
(ii) Calculate the length AC.

Answer(a)(ii) AC = ... m [4]

(iii) Calculate the area of triangle *ABC*.

Answer(a)(iii) ..... m^2 [2]

(b)



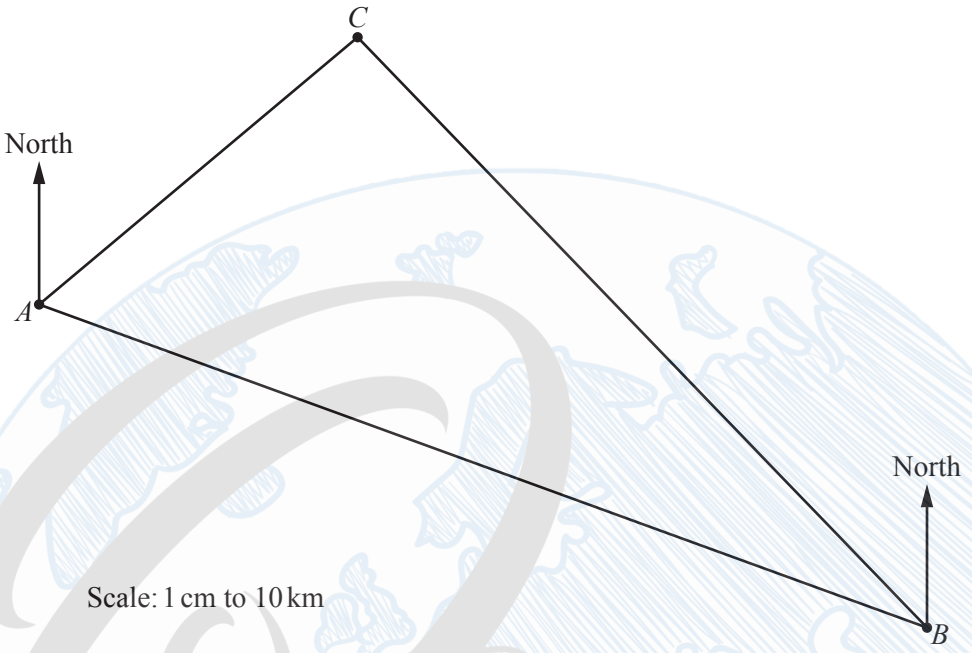
NOT TO SCALE

A cuboid has length 45 cm, width 22 cm and height 12 cm.

Calculate the length of the straight line *XY*.

Answer(b) XY = ... cm [4]

7 The scale drawing shows the positions of three towns A, B and C on a map.
The scale of the map is 1 centimetre represents 10 kilometres.



(a) Find the actual distance AB.

Answer(a) ..... km [1]

(b) Measure the bearing of A from B.

Answer(b) ..... [1]

(c) Write the scale 1 cm to 10 km in the form $1 : n$.

Answer(c) 1 : ..... [1]

(d) A national park lies **inside** the triangle ABC.
The four boundaries of the national park are

- equidistant from C and B
- equidistant from AC and CB
- 15 km from CB
- along AB.

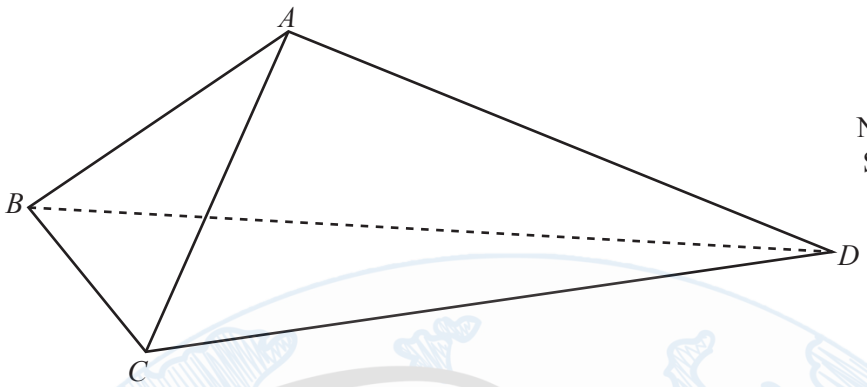
On the scale drawing, shade the region which represents the national park.
Leave in your construction arcs. [7]

(e) On the scale drawing, a lake inside the national park has area $0.4\,\text{cm}^2$.

Calculate the actual area of the lake.

Answer(e) ..... km^2 [2]

4



NOT TO SCALE

The diagram shows a tent $ABCD$.
The front of the tent is an isosceles triangle ABC, with $AB = AC$.
The sides of the tent are congruent triangles ABD and ACD.

(a) $BC = 1.2$ m and angle $ABC = 68°$.

Find AC.

Answer(a) $AC =$ ..... m [3]

(b) $CD = 2.3$ m and $AD = 1.9$ m.

Find angle ADC.

Answer(b) Angle $ADC =$ ..... [4]

(c) The floor of the tent, triangle BCD, is also an isosceles triangle with $BD = CD$.

Calculate the area of the floor of the tent.

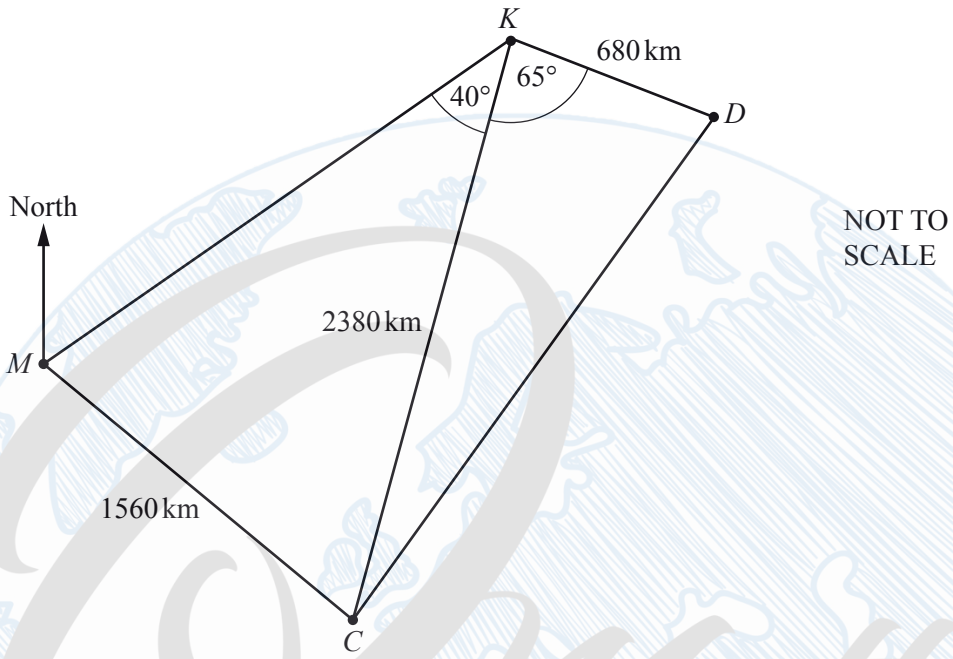
Answer(c) .....m^2 [4]

(d) When the tent is on horizontal ground, A is a vertical distance 1.25 m above the ground.

Calculate the angle between AD and the ground.

Answer(d) ..... [3]

5



The diagram shows some distances between Mumbai (*M*), Kathmandu (*K*), Dhaka (*D*) and Colombo (*C*).

(a) Angle *CKD* = 65°.

Use the cosine rule to calculate the distance *CD*.

Answer(a) CD = ... km [4]

(b) Angle $MKC = 40°$.

Use the sine rule to calculate the acute angle KMC.

Answer(b) Angle KMC = ... [3]

(c) The bearing of K from M is 050°.

Find the bearing of M from C.

Answer(c) ..... [2]

(d) A plane from Colombo to Mumbai leaves at 21 15 and the journey takes 2 hours 24 minutes.

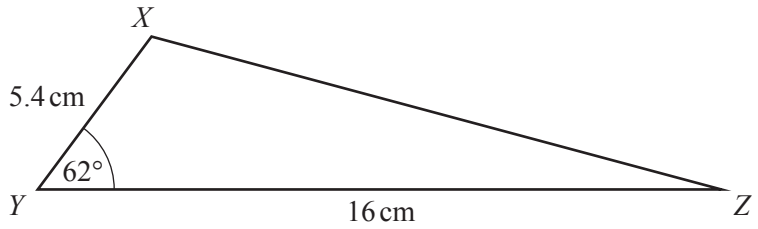
(i) Find the time the plane arrives at Mumbai.

Answer(d)(i) ..... [1]

(ii) Calculate the average speed of the plane.

Answer(d)(ii) ..... km/h [2]

5 (a)



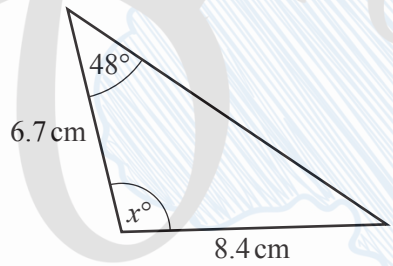
NOT TO SCALE

Show that the area of triangle XYZ is 38.1 cm^2, correct to 1 decimal place.

Answer(a)

[2]

(b)

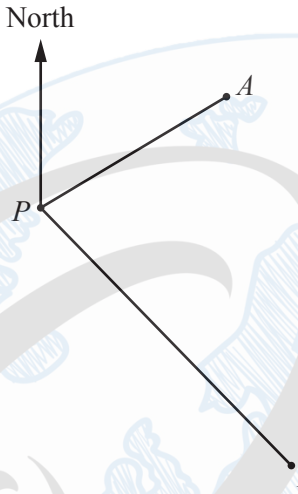


NOT TO SCALE

Calculate the value of x.

Answer(b) x = [4]

(c)



NOT TO SCALE

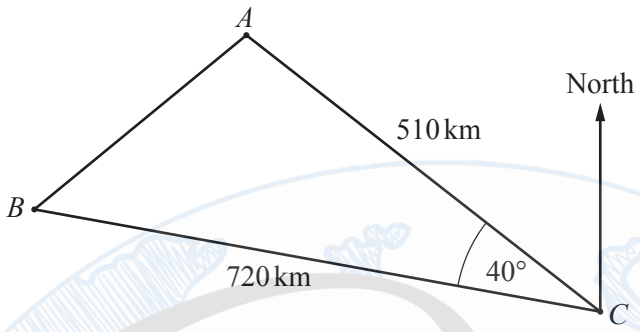
Ship A is 180 kilometres from port P on a bearing of 063°.
Ship B is 245 kilometres from P on a bearing of 146°.

Calculate AB, the distance between the two ships.

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

5

NOT TO SCALE



A plane flies from A to C and then from C to B.
$AC = 510$ km and $CB = 720$ km.
The bearing of C from A is 135° and angle $ACB = 40°$.

(a) Find the bearing of

(i) B from C,

..... [2]

(ii) C from B.

..... [2]

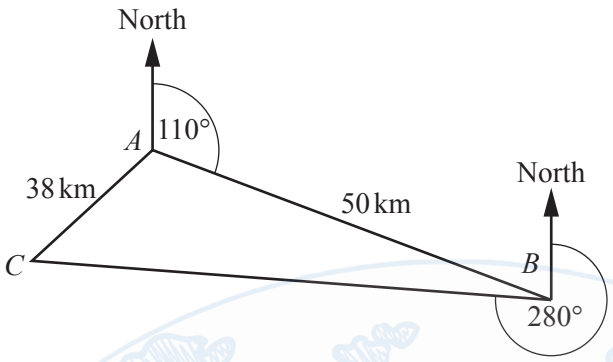
(b) Calculate AB and show that it rounds to 464.7 km, correct to 1 decimal place.

[4]

(c) Calculate angle ABC.

Angle ABC = ... [3]

8 (a)



NOT TO SCALE

A, *B* and *C* are three towns.
The bearing of *B* from *A* is 110°.
The bearing of *C* from *B* is 280°.
$AC = 38$ km and $AB = 50$ km.

(i) Find the bearing of *A* from *B*.

..... [2]

(ii) Calculate angle *BAC*.

Angle *BAC* = ... [5]

(iii) A road is built from *A* to join the straight road *BC*.

Calculate the shortest possible length of this new road.

..... km [3]

(b) Town A has a rectangular park.
The length of the park is x m.
The width of the park is 25 m shorter than the length.
The area of the park is 2200 m^2.

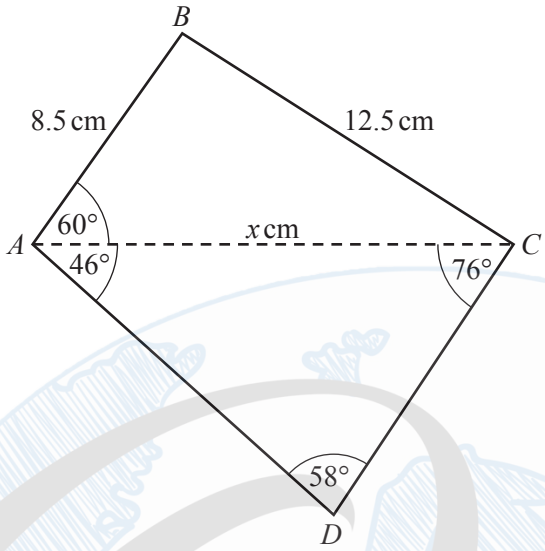
(i) Show that $x^2 - 25x - 2200 = 0$.

[1]

(ii) Solve $x^2 - 25x - 2200 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

10



NOT TO SCALE

The diagram shows a quadrilateral $ABCD$.

(a) The length of AC is x cm.

Use the cosine rule in triangle ABC to show that $2x^2 - 17x - 168 = 0$.

[4]

(b) Solve the equation $2x^2 - 17x - 168 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

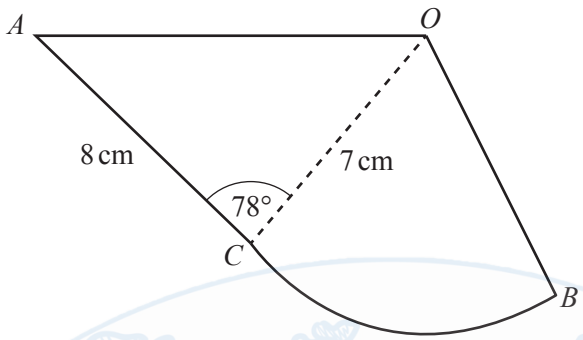
(c) Use the sine rule to calculate the length of CD.

CD = ... cm [3]

(d) Calculate the area of the quadrilateral $ABCD$.

..... cm^2 [3]

5



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]

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

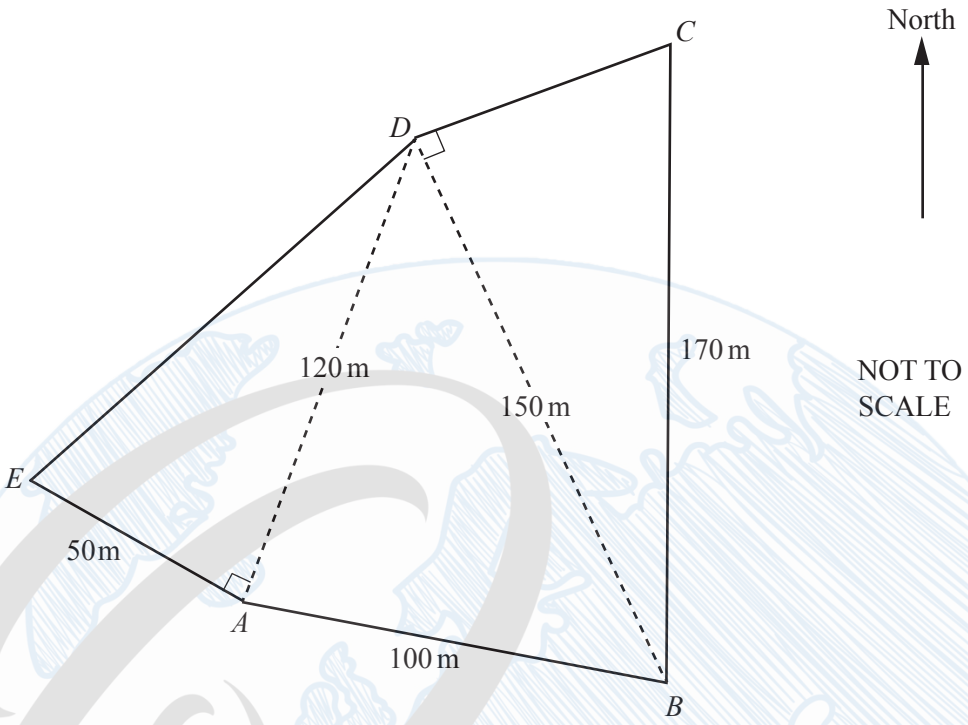
Show that angle $COB = 41.2°$, correct to 1 decimal place.

[5]

(d) Calculate the total area of the design.

..... cm^2 [4]

3



The diagram shows a field *ABCDE*.

(a) Calculate the perimeter of the field *ABCDE*.

..... m [4]

(b) Calculate angle *ABD*.

Angle *ABD* = ... [4]

(c) **(i)** Calculate angle *CBD*.

Angle *CBD* = ... [2]

(ii) The point *C* is due north of the point *B*.

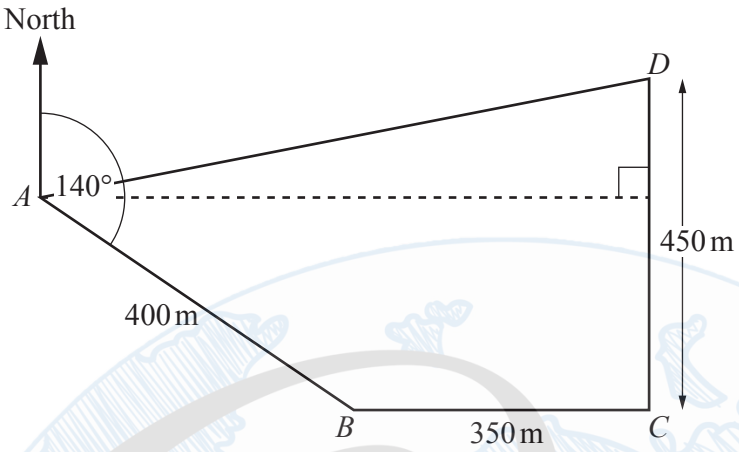
Find the bearing of *D* from *B*.

..... [2]

(d) Calculate the area of the field *ABCDE*.
Give your answer in hectares.
[1 hectare = 10 000 m^2]

..... hectares [4]

5



The diagram shows a field $ABCD$.
The bearing of B from A is 140°.
C is due east of B and D is due north of C.
$AB = 400$ m, $BC = 350$ m and $CD = 450$ m.

(a) Find the bearing of D from B.

..... [2]

(b) Calculate the distance from D to A.

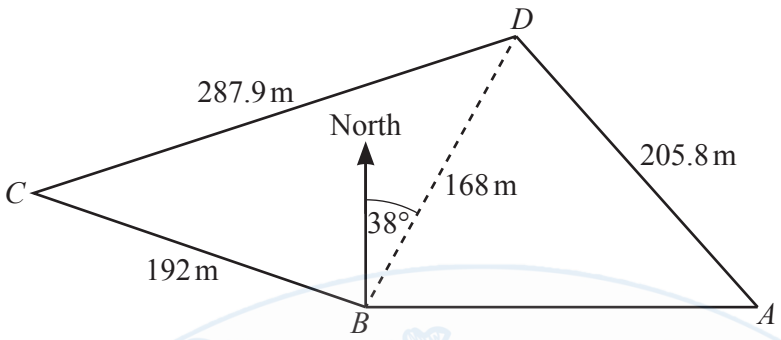
..... m [6]

(c) Jono runs around the field from A to B, B to C, C to D and D to A.
He runs at a speed of 3 m/s.

Calculate the total time Jono takes to run around the field.
Give your answer in minutes and seconds, correct to the nearest second.

..... min ..... s [4]

6



NOT TO SCALE

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.

[4]

(ii) The bearing of *D* from *B* is 038°.

Find the bearing of *C* from *B*.

..... [1]

(iii) *A* is **due east** of *B*.

Calculate the bearing of *D* from *A*.

..... [5]

(b) (i) Calculate the area of triangle *BCD*.

..... m^2 [2]

(ii) Tomas buys the triangular part of the field, *BCD*.
The cost is \$35 750 per hectare.

Calculate the amount he pays.
Give your answer correct to the nearest \$100.
[1 hectare = 10 000 m^2]

\$ ..... [2]