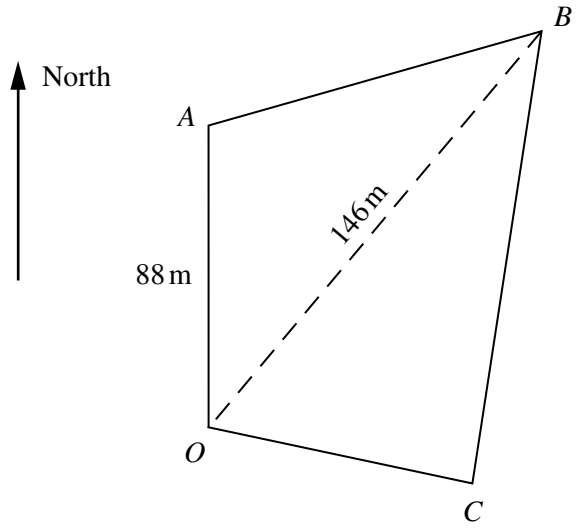
2



NOT TO SCALE

OABC is a field.
A is 88 metres due North of *O*.
B is 146 metres from *O* on a bearing of 040°.
C is equidistant from *A* and from *B*. The bearing of *C* from *O* is 098°.

(a) Using a scale of 1 centimetre to represent 10 metres, make an accurate scale drawing of the field *OABC*, by

(i) constructing the triangle *OAB*, [3]

(ii) drawing the locus of points equidistant from *A* and from *B*, [2]

(iii) completing the scale diagram of *OABC*. [2]

(b) Use your scale drawing to write down

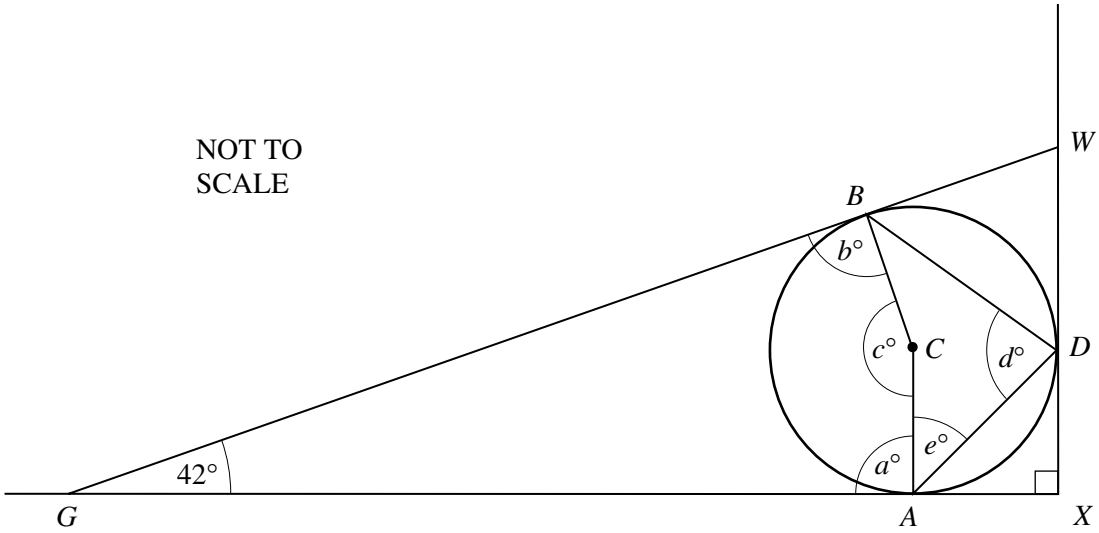
(i) the distance *OC* correct to the nearest metre, [1]

(ii) the size of angle *OAB* correct to the nearest degree. [1]

(c) Find the bearing of *A* from *B*. [2]

(d) A donkey in the field is not more than 40 metres from *C* and is closer to *B* than to *A*.
Shade the area where the donkey could be and label it *D*. [3]

(e) A horse in the field is not more than 20 metres from the side *AB* and is closer to *A* than to *B*.
Shade the area where the horse could be and label it *H*. [3]



A sphere, centre C, rests on horizontal ground at A and touches a vertical wall at D.
A straight plank of wood, GBW, touches the sphere at B, rests on the ground at G and against the wall at W.
The wall and the ground meet at X.
Angle $WGX = 42°$.

(a) Find the values of a, b, c, d and e marked on the diagram. [5]

(b) Write down one word which completes the following sentence.

'Angle CGA is 21° because triangle GBC and triangle GAC are ……'. [1]

(c) The radius of the sphere is 54 cm.

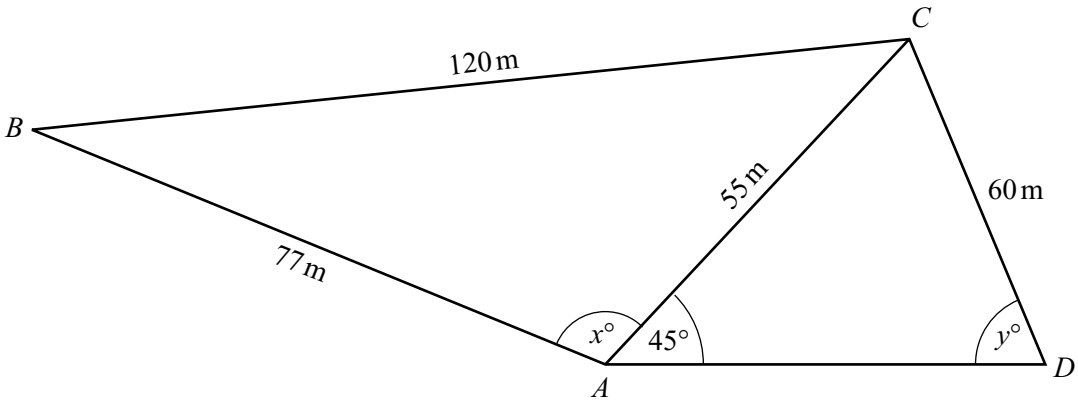
(i) Calculate the distance GA. Show all your working. [3]

(ii) Show that $GX = 195$ cm correct to the nearest centimetre. [1]

(iii) Calculate the length of the plank GW. [3]

(iv) Find the distance BW. [1]

2



NOT TO SCALE

In quadrilateral $ABCD$, $AB = 77$ m, $BC = 120$ m, $CD = 60$ m and diagonal $AC = 55$ m.
Angle $CAD = 45°$, angle $BAC = x°$ and angle $ADC = y°$.

(a) Calculate the value of x. [4]

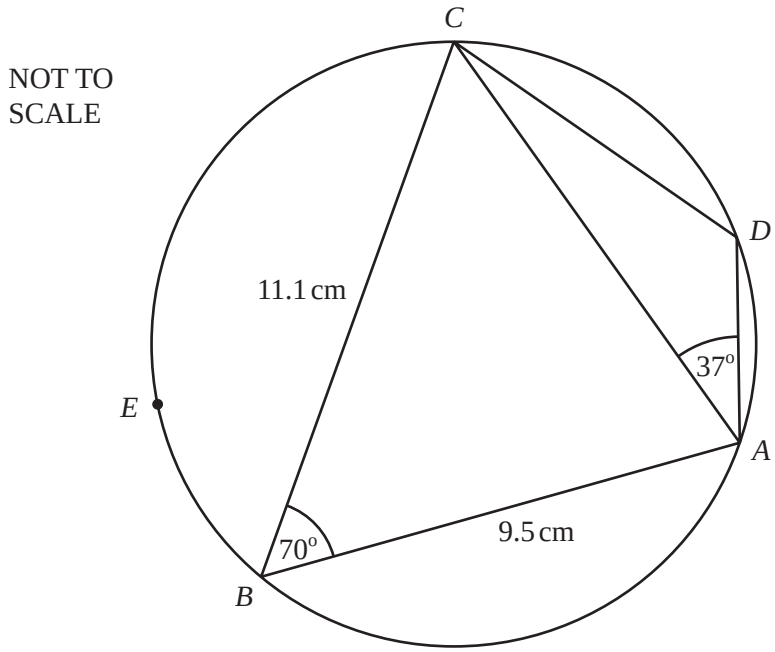
(b) Calculate the value of y. [4]

(c) The bearing of D from A is 090°.
Find the bearing of

(i) A from C, [2]

(ii) B from A. [2]

4



ABCD is a cyclic quadrilateral.
$AB = 9.5$ cm, $BC = 11.1$ cm, angle $ABC = 70^o$ and angle $CAD = 37^o$.

(a) Calculate the length of *AC*. [4]

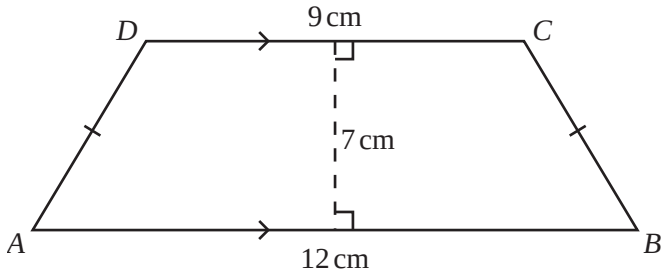
(b) Explain why angle $ADC = 110^o$. [1]

(c) Calculate the length of *AD*. [4]

(d) A point *E* lies on the circle such that triangle *ACE* is isosceles, with *EA* = *EC*.

(i) Write down the size of angle *AEC*. [1]

(ii) Calculate the area of triangle *ACE*. [3]



NOT TO SCALE

The diagram shows a trapezium $ABCD$.
$AB = 12$ cm, $DC = 9$ cm and the perpendicular distance between these parallel sides is 7 cm.
$AD = BC$.

(a) Approximately halfway down your page, draw a line AB of length 12 cm. [1]

(b) Using a straight edge and compasses only, construct the perpendicular bisector of AB. [2]

(c) Complete an **accurate** drawing of the trapezium $ABCD$. [2]

(d) **Measure** angle ABC, giving your answer correct to the nearest degree. [1]

(e) Use trigonometry to calculate angle ABC.
Show all your working and give your answer correct to 1 decimal place. [2]

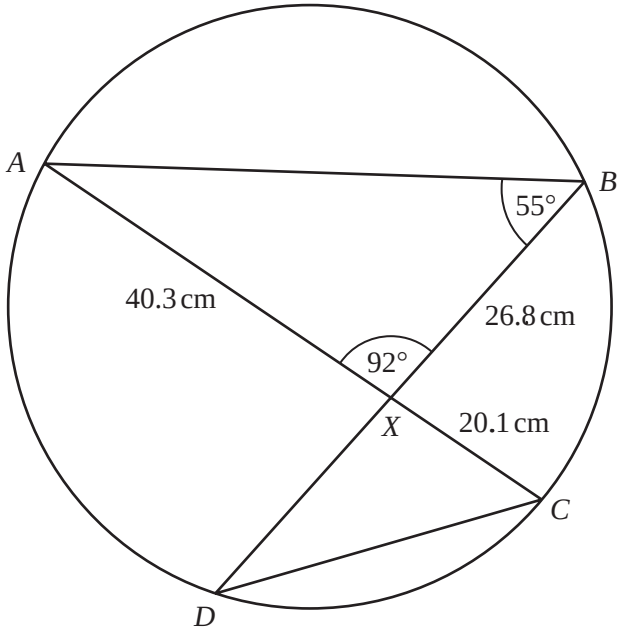
(f) On your diagram,

(i) draw the locus of points inside the trapezium which are 5 cm from D, [1]

(ii) using a straight edge and compasses only, construct the locus of points equidistant from DA and from DC, [2]

(iii) shade the region inside the trapezium containing points which are less than 5 cm from D **and** nearer to DA than to DC. [1]

3 (a)



NOT TO SCALE

A, B, C and D lie on a circle.

AC and BD intersect at X.

Angle $ABX = 55°$ and angle $AXB = 92°$.

$BX = 26.8$ cm, $AX = 40.3$ cm and $XC = 20.1$ cm.

(i) Calculate the area of triangle AXB.
You must show your working. [2]

(ii) Calculate the length of AB.
You must show your working. [3]

(iii) Write down the size of angle ACD. Give a reason for your answer. [2]

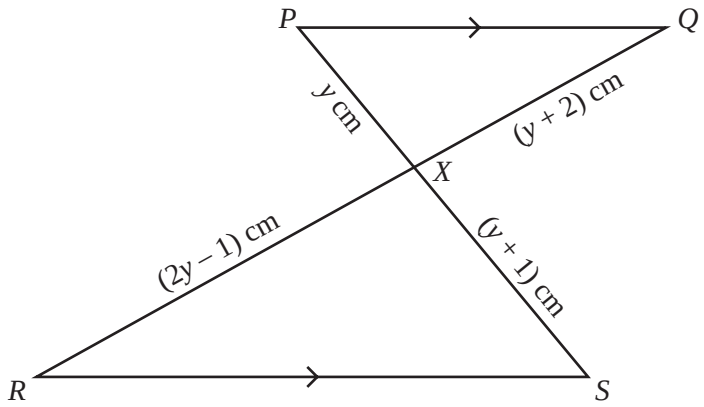
(iv) Find the size of angle BDC. [1]

(v) Write down the geometrical word which completes the statement

"Triangle AXB is ——— to triangle DXC." [1]

(vi) Calculate the length of XD.
You must show your working. [2]

(b)



NOT TO SCALE

In the diagram PQ is parallel to RS.

PS and QR intersect at X.

$PX = y$ cm, $QX = (y + 2)$ cm, $RX = (2y – 1)$ cm and $SX = (y + 1)$ cm.

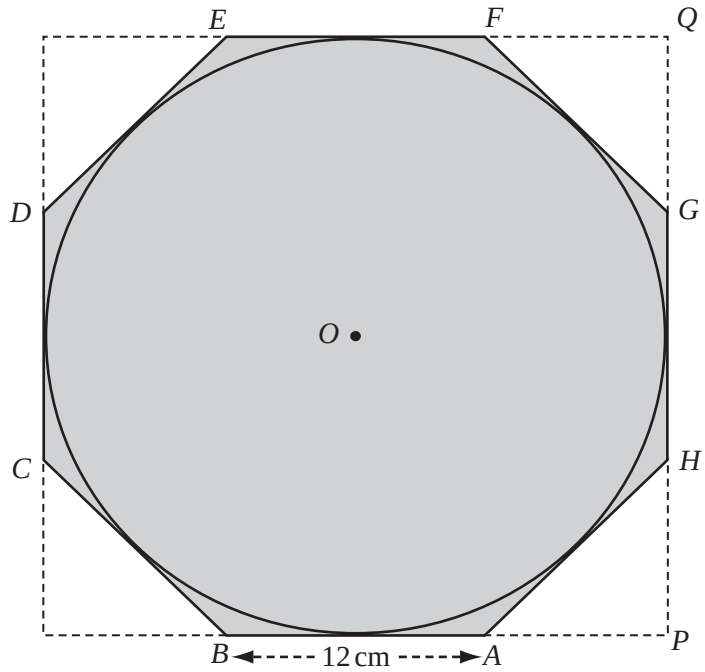
(i) Show that $y^2 – 4y – 2 = 0$. [3]

(ii) Solve the equation $y^2 – 4y – 2 = 0$.

Show all your working and give your answers correct to two decimal places. [4]

(iii) Write down the length of RX. [1]

NOT TO SCALE



A circle, centre O, touches all the sides of the regular octagon $ABCDEFGH$ shaded in the diagram.

The sides of the octagon are of length 12 cm.

BA and GH are extended to meet at P. HG and EF are extended to meet at Q.

(a) **(i)** Show that angle BAH is 135°. [2]

(ii) Show that angle APH is 90°. [1]

(b) Calculate

(i) the length of PH, [2]

(ii) the length of PQ, [2]

(iii) the area of triangle APH, [2]

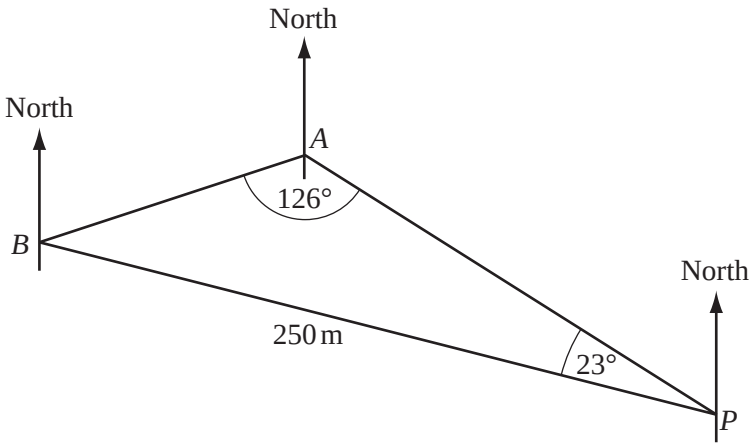
(iv) the area of the octagon. [3]

(c) Calculate

(i) the radius of the circle, [2]

(ii) the area of the circle as a percentage of the area of the octagon. [3]

4



NOT TO SCALE

The diagram shows three straight horizontal roads in a town, connecting points P, A and B.

PB =250 m, angle APB = 23° and angle BAP = 126°.

(a) Calculate the length of the road AB.

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

(b) The bearing of A from P is 303°.

Find the bearing of

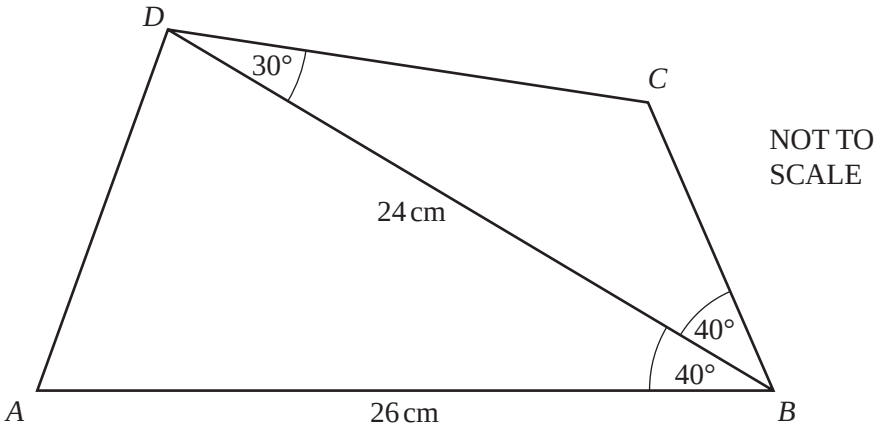
(i) B from P,

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

(ii) A from B.

For Examiner's Use

5



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*.

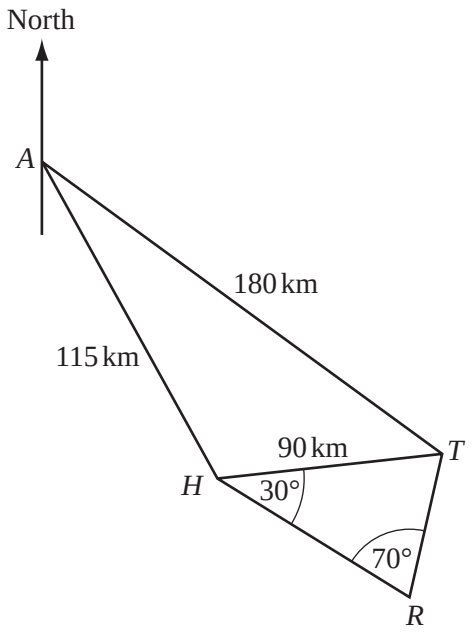
Answer(c) ..... cm [4]

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

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

5

For Examiner's Use



NOT TO SCALE

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]

For Examiner's Use

(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.

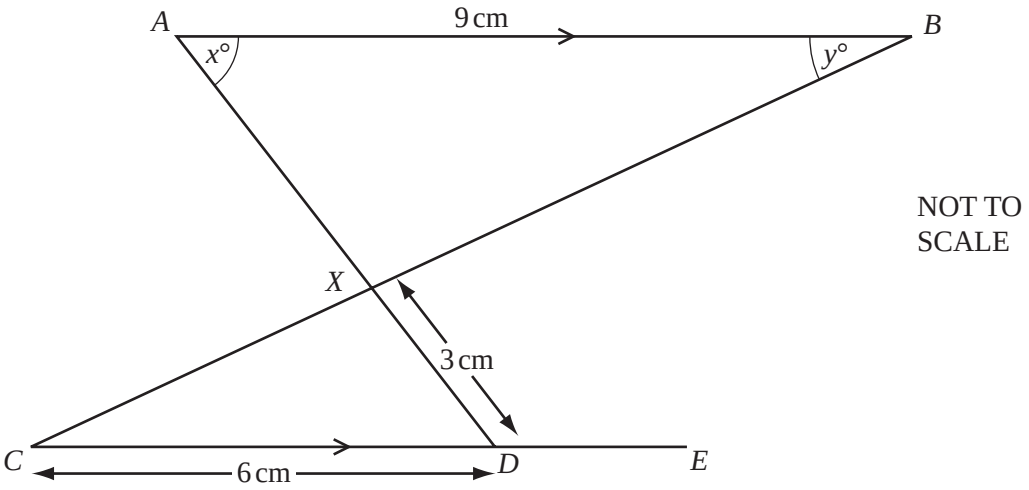
The scale of the map is $1 : n$.

Calculate the value of n.

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

For Examiner's Use

9 (a)



NOT TO SCALE

The lines *AB* and *CDE* are parallel.
AD and *CB* intersect at *X*.
AB = 9 cm, *CD* = 6 cm and *DX* = 3 cm.

(i) Complete the following statement.

Triangle *ABX* is ..... to triangle *DCX*. [1]

(ii) Calculate the length of *AX*.

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

(iii) The area of triangle *DCX* is 6 cm^2.

Calculate the area of triangle *ABX*.

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

(iv) Angle *BAX* = *x*° and angle *ABX* = *y*°.

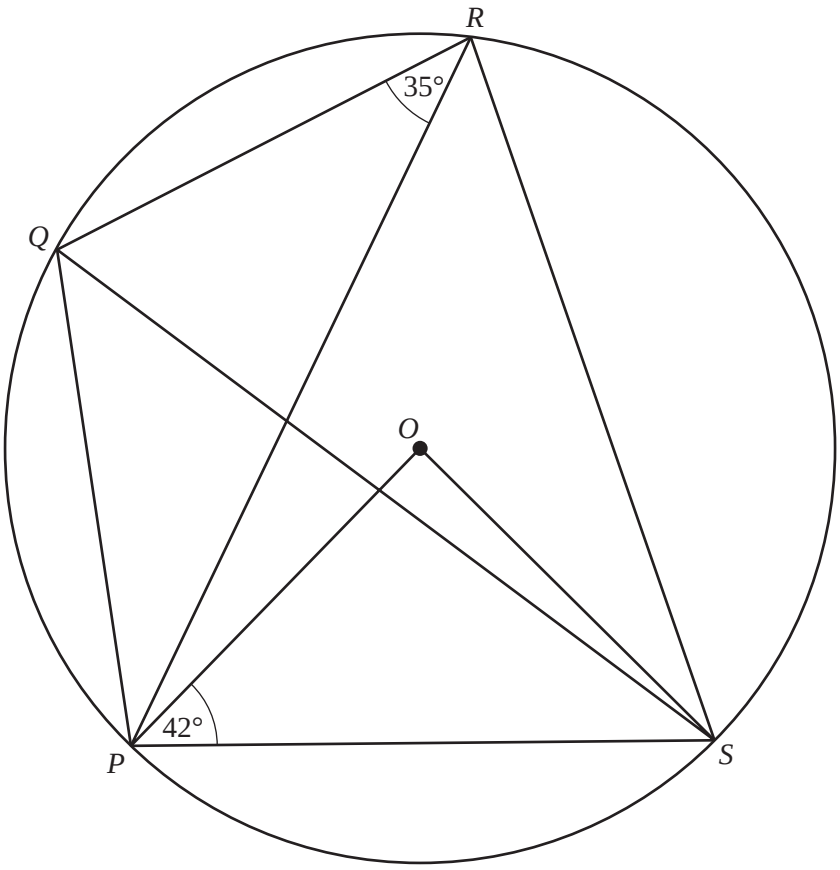
Find angle *AXB* and angle *XDE* in terms of *x* and/or *y*.

Answer(a)(iv) Angle *AXB* = ...

Angle *XDE* = ... [2]

For Examiner's Use

(b)



NOT TO SCALE

P, *Q*, *R* and *S* lie on a circle, centre *O*.
Angle *OPS* = 42° and angle *PRQ* = 35°.

Calculate

(i) angle *POS*,

Answer(b)(i) Angle *POS* = ... [1]

(ii) angle *PRS*,

Answer(b)(ii) Angle *PRS* = ... [1]

(iii) angle *SPQ*,

Answer(b)(iii) Angle *SPQ* = ... [1]

(iv) angle *PSQ*.

Answer(b)(iv) Angle *PSQ* = ... [1]

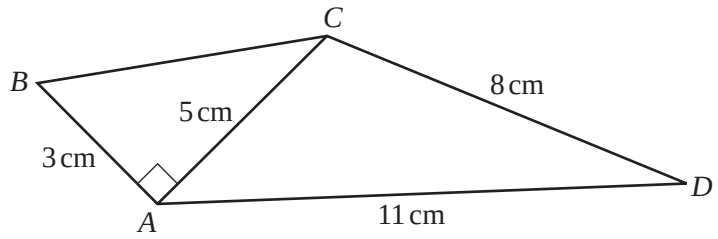
(c) The interior angle of a regular polygon is 8 times as large as the exterior angle.

Calculate the number of sides of the polygon.

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

For Examiner's Use

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,

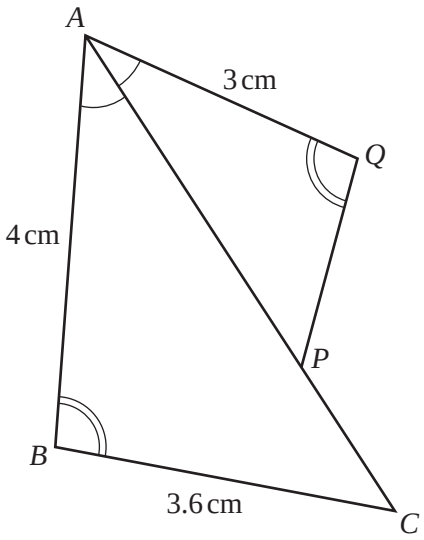
Answer(b) Angle $ACD =$ ..... [4]

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

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

For Examiner's Use

5 (a)



NOT TO SCALE

The diagram shows two triangles *ACB* and *APQ*.

Angle *PAQ* = angle *BAC* and angle *AQP* = angle *ABC*.

AB = 4 cm, *BC* = 3.6 cm and *AQ* = 3 cm.

(i) Complete the following statement.

Triangle *ACB* is ..... to triangle *APQ*. [1]

(ii) Calculate the length of *PQ*.

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

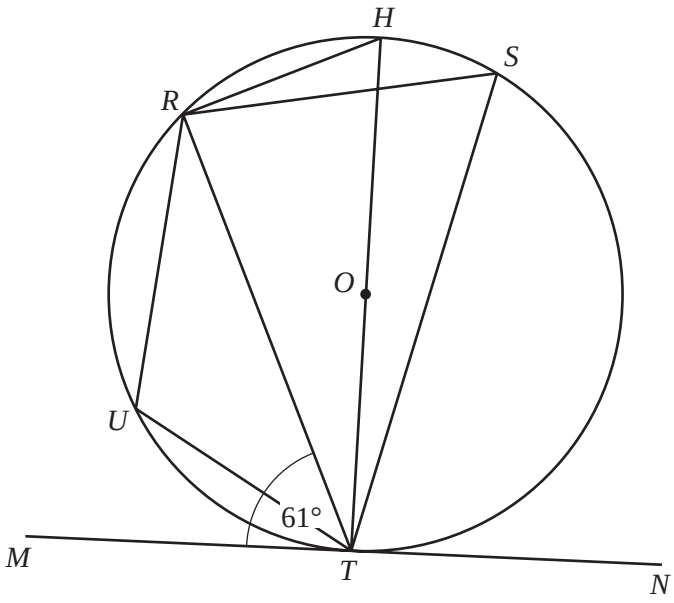
(iii) The area of triangle *ACB* is 5.6 cm^2.

Calculate the area of triangle *APQ*.

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

For Examiner's Use

(b)



NOT TO SCALE

R, *H*, *S*, *T* and *U* lie on a circle, centre *O*.
HT is a diameter and *MN* is a tangent to the circle at *T*.
Angle *RTM* = 61°.

Find

(i) angle *RTH*,

Answer(b)(i) Angle *RTH* = ... [1]

(ii) angle *RHT*,

Answer(b)(ii) Angle *RHT* = ... [1]

(iii) angle *RST*,

Answer(b)(iii) Angle *RST* = ... [1]

(iv) angle *RUT*.

Answer(b)(iv) Angle *RUT* = ... [1]

(c) *ABCDEF* is a hexagon.
The interior angle *B* is 4° greater than interior angle *A*.
The interior angle *C* is 4° greater than interior angle *B*, and so on, with each of the next interior angles 4° greater than the previous one.

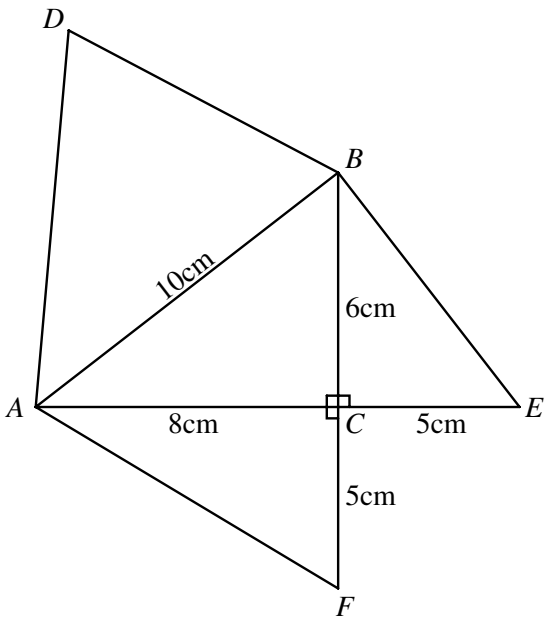
(i) By how many degrees is interior angle *F* greater than interior angle *A*?

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

(ii) Calculate interior angle *A*.

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

2



NOT TO SCALE

The diagram shows a sketch of the net of a solid tetrahedron (triangular prism).
The right-angled triangle ABC is its base.
$AC = 8$ cm, $BC = 6$ cm and $AB = 10$ cm. $FC = CE = 5$ cm.

(a) **(i)** Show that $BE = \sqrt{61}$ cm. [1]

(ii) Write down the length of DB. [1]

(iii) Explain why $DA = \sqrt{89}$ cm. [2]

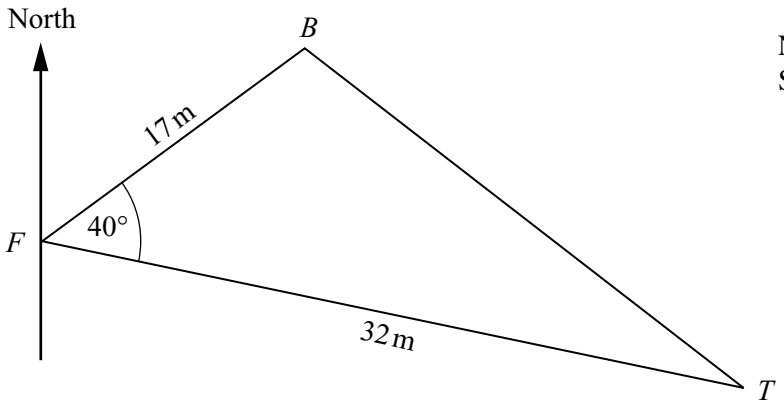
(b) **Calculate** the size of angle DBA. [4]

(c) Calculate the area of triangle DBA. [3]

(d) Find the total surface area of the solid. [3]

(e) Calculate the volume of the solid.
[The volume of a tetrahedron is $\frac{1}{3}$ (area of the base) $\times$ perpendicular height.] [3]

3



NOT TO SCALE

Felipe (F) stands 17 metres from a bridge (B) and 32 metres from a tree (T).
The points F, B and T are on level ground and angle $BFT = 40°$.

(a) Calculate

(i) the distance BT, [4]

(ii) the angle BTF. [3]

(b) The bearing of B from F is 085°. Find the bearing of

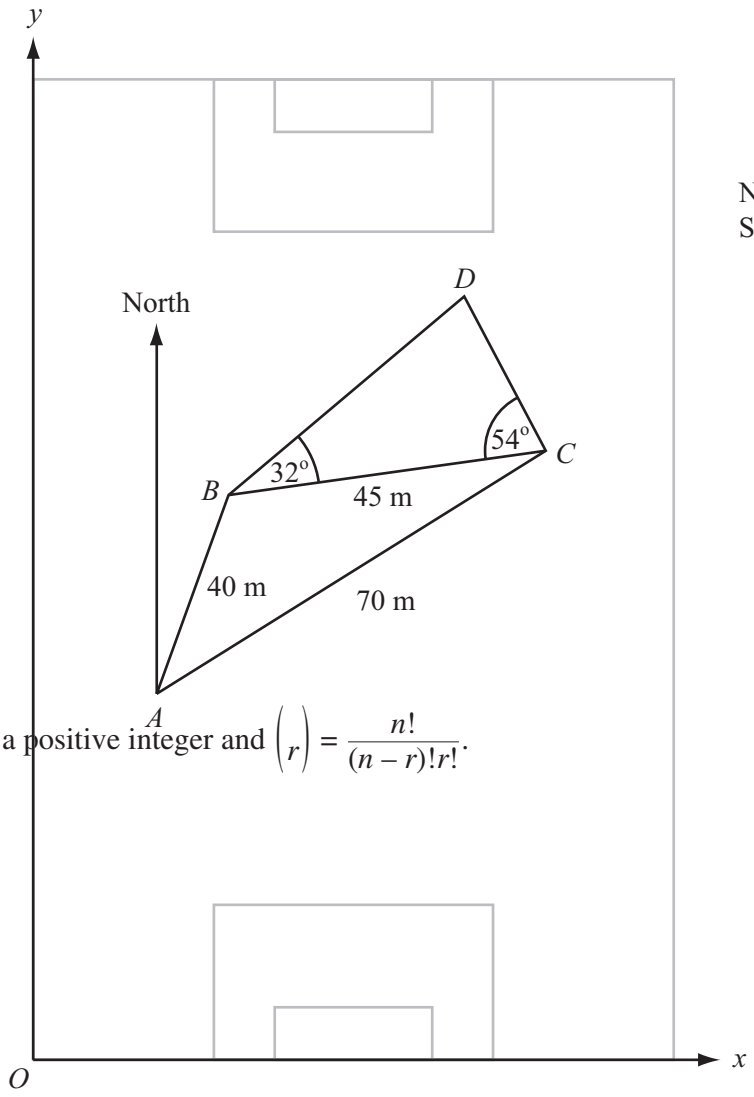
(i) T from F, [1]

(ii) F from T, [1]

(iii) B from T. [1]

(c) The top of the tree is 30 metres vertically above T.
Calculate the angle of elevation of the top of the tree from F. [2]

5



where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

(a) During a soccer match a player runs from A to B and then from B to C as shown in the diagram. $AB = 40$ m, $BC = 45$ m and $AC = 70$ m.

(i) Show by calculation that angle $BAC = 37°$, correct to the nearest degree. [3]

(ii) The bearing of C from A is 051°. Find the bearing of B from A. [1]

(iii) Calculate the area of triangle ABC. [3]

(b) x- and y-axes are shown in the diagram.

$\overrightarrow{AC} = \begin{pmatrix} p \\ q \end{pmatrix}$, where p and q are measured in metres.

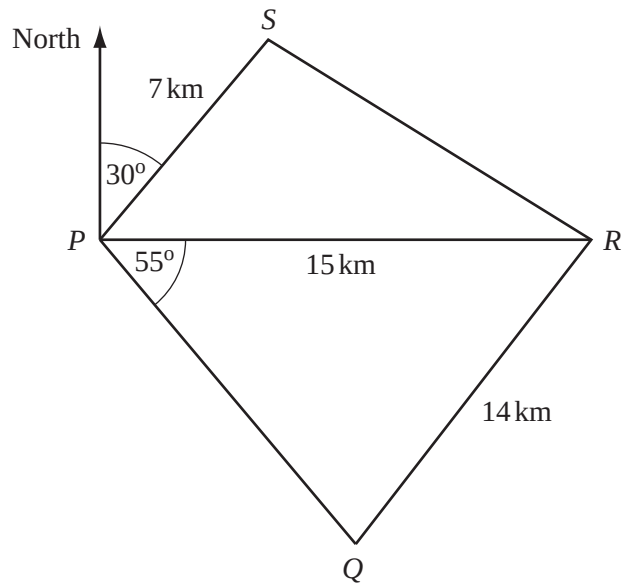
(i) Show that $p = 54.4$. [2]

(ii) Find the value of q. [2]

(c) Another player is standing at D.
$BC = 45$ m, angle $BCD = 54°$ and angle $DBC = 32°$.
Calculate the length of BD. [4]

3

NOT TO SCALE



The quadrilateral *PQRS* shows the boundary of a forest.
A straight 15 kilometre road goes due East from *P* to *R*.

(a) The bearing of *S* from *P* is 030° and *PS* = 7 km.

(i) Write down the size of angle *SPR*. [1]

(ii) Calculate the length of *RS*. [4]

(b) Angle *RPQ* = 55° and *QR* = 14 km.

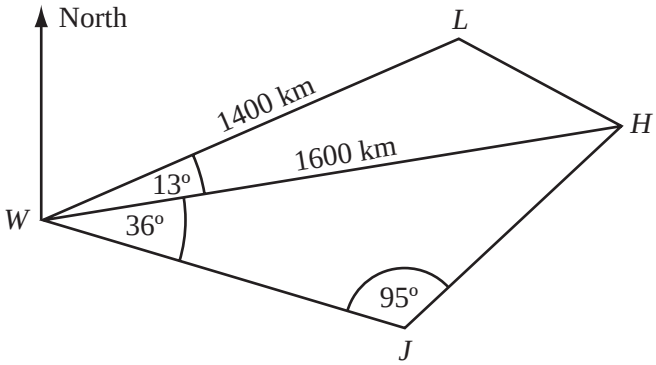
(i) Write down the bearing of *Q* from *P*. [1]

(ii) Calculate the acute angle *PQR*. [3]

(iii) Calculate the length of *PQ*. [3]

(c) Calculate the area of the forest, correct to the nearest square kilometre. [4]

2



NOT TO SCALE

The diagram shows the positions of four cities in Africa, Windhoek (W), Johannesburg (J), Harari (H) and Lusaka (L).
WL = 1400 km and WH = 1600 km.
Angle LWH = 13°, angle HWJ = 36° and angle WJH = 95°.

(a) Calculate the distance LH. [4]

(b) Calculate the distance WJ. [4]

(c) Calculate the area of quadrilateral $WJHL$. [3]

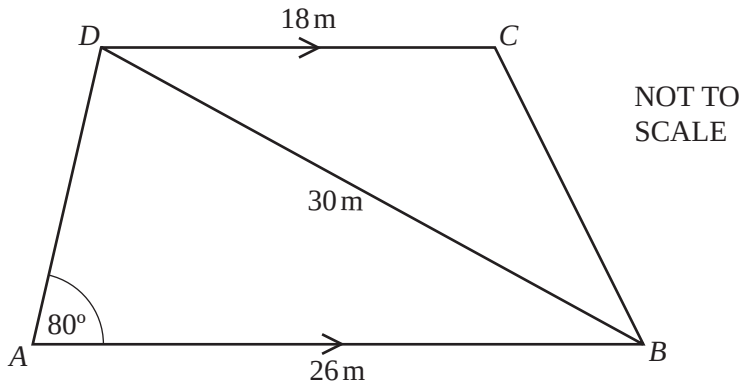
(d) The bearing of Lusaka from Windhoek is 060°.
Calculate the bearing of

(i) Harari from Windhoek, [1]

(ii) Windhoek from Johannesburg. [1]

(e) On a map the distance between Windhoek and Harari is 8 cm.
Calculate the scale of the map in the form 1:n. [2]

6



The diagram shows the plan of a garden.

The garden is a trapezium with $AB = 26$ metres, $DC = 18$ metres and angle $DAB = 80°$.

A straight path from B to D has a length of 30 metres.

(a) (i) Using a scale of 1 : 200, draw an **accurate** plan of the garden. [3]

(ii) **Measure** and write down the size of angle ADB and the size of angle DCB. [2]

(iii) A second path is such that all points on it are equidistant from AB and from AD.

Using a straight edge and compasses only, construct this path on your plan. [2]

(iv) A third path is such that all points on it are equidistant from A and from D.

Using a straight edge and compasses only, construct this path on your plan. [2]

(v) In the garden, vegetables are grown in the region which is nearer to AB than to AD **and** nearer to A than to D.

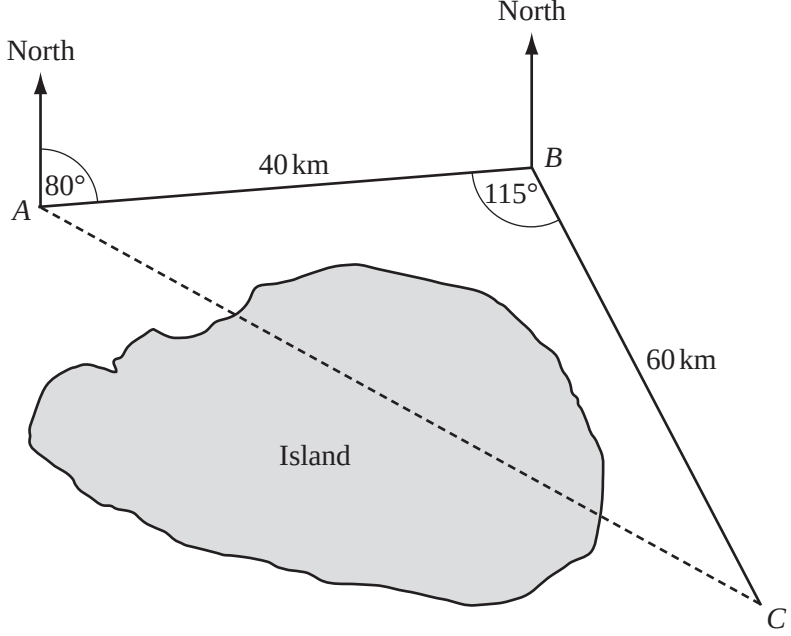
Shade this region on your plan. [1]

(b) **Use trigonometry**, showing all your working, to calculate

(i) angle ADB, [3]

(ii) the length of BC, [4]

(iii) the area of the garden. [3]



NOT TO SCALE

To avoid an island, a ship travels 40 kilometres from A to B and then 60 kilometres from B to C.

The bearing of B from A is 080° and angle ABC is 115°.

(a) The ship leaves A at 11 55.

It travels at an average speed of 35 km / h.

Calculate, to the nearest minute, the time it arrives at C. [3]

(b) Find the bearing of

(i) A from B, [1]

(ii) C from B. [1]

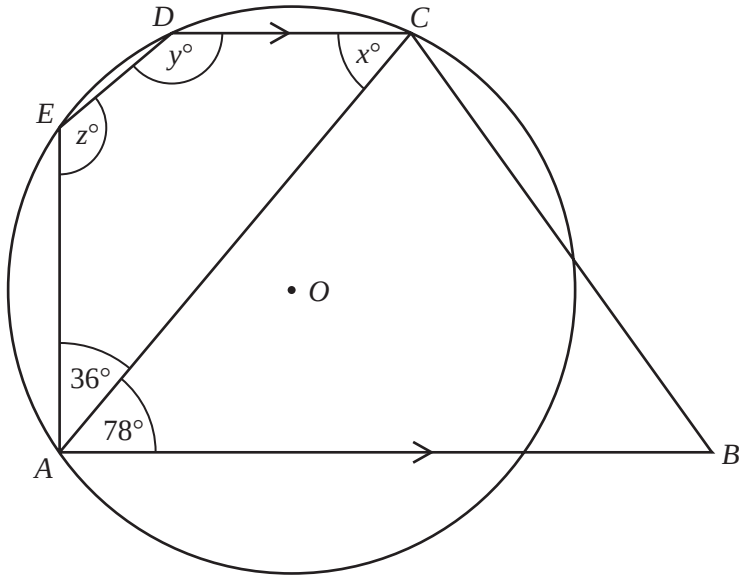
(c) Calculate the straight line distance AC. [4]

(d) Calculate angle BAC. [3]

(e) Calculate how far C is **east** of A. [3]

8

NOT TO SCALE



ABCDE is a pentagon.
A circle, centre *O*, passes through the points *A*, *C*, *D* and *E*.
Angle *EAC* = 36°, angle *CAB* = 78° and *AB* is parallel to *DC*.

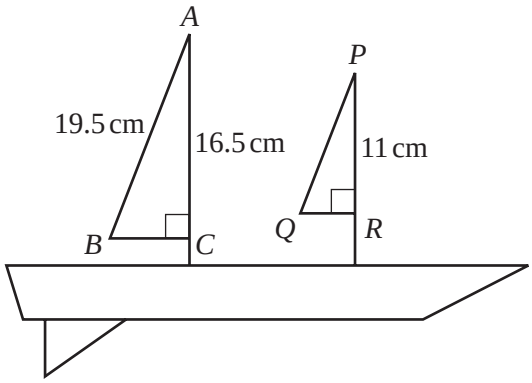
(a) Find the values of *x*, *y* and *z*, giving a reason for each. [6]

(b) Explain why *ED* is **not** parallel to *AC*. [1]

(c) Find the value of angle *EOC*. [1]

(d) *AB* = *AC*.
Find the value of angle *ABC*. [1]

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]

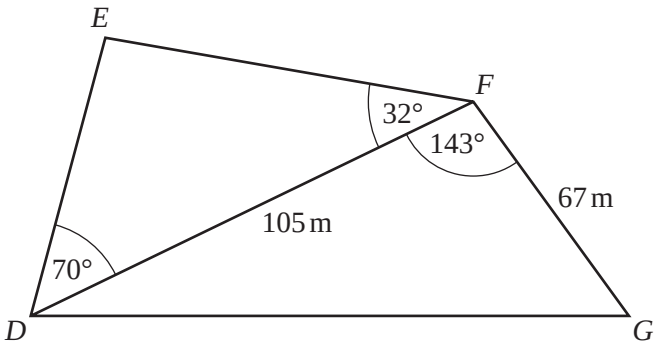
(iii) Calculate angle ABC.

(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)



NOT TO SCALE

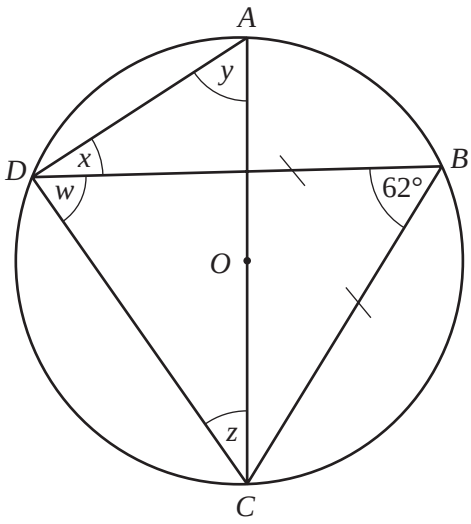
The diagram shows a field *DEFG*, in the shape of a quadrilateral, with a footpath along the diagonal *DF*.
DF = 105 m and *FG* = 67 m.
Angle *EDF* = 70°, angle *EFD* = 32° and angle *DFG* = 143°.

(i) Calculate *DG*.

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

(ii) Calculate *EF*.

7 **(a)**



NOT TO SCALE

A, B, C and D are points on the circumference of a circle centre O.
AC is a diameter.
$BD = BC$ and angle $DBC = 62°$.

Work out the values of w, x, y and z.
Give a reason for each of your answers.

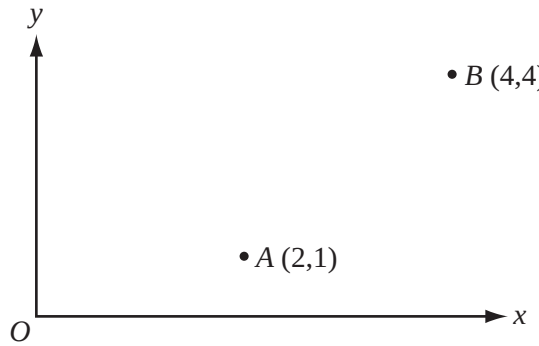
$w =$ ..... because ..... [2]

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

$y =$ ..... because ..... [2]

$z =$ ..... because ..... [2]

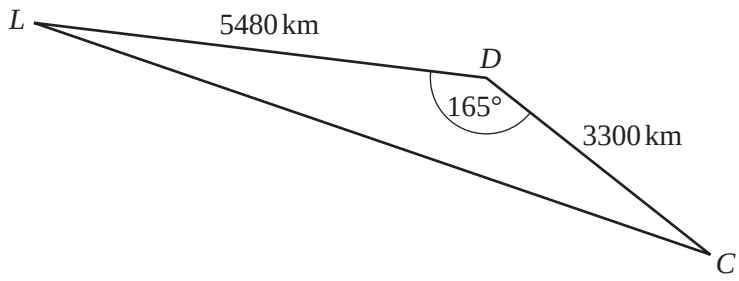
(b)



NOT TO SCALE

(i) Write down $\overrightarrow{AB}$ as a column vector.

6



NOT TO SCALE

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.

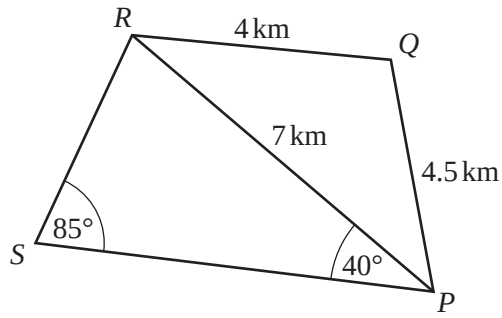
Answer(a)(i)

[4]

(ii) Calculate the angle CLD.

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

2



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.]