Trigonometry & Bearings
2002 - 2011

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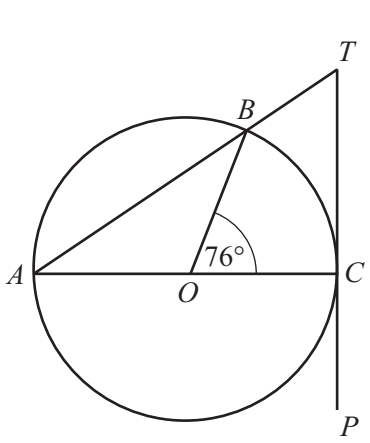

NOT TO SCALE

AOC is a diameter of the circle, centre *O*.
AT is a straight line that cuts the circle at *B*.
PT is the tangent to the circle at *C*.
Angle *COB* = 76°.

(a) Calculate angle *ATC*.

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

(b) *T* is due north of *C*.

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

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

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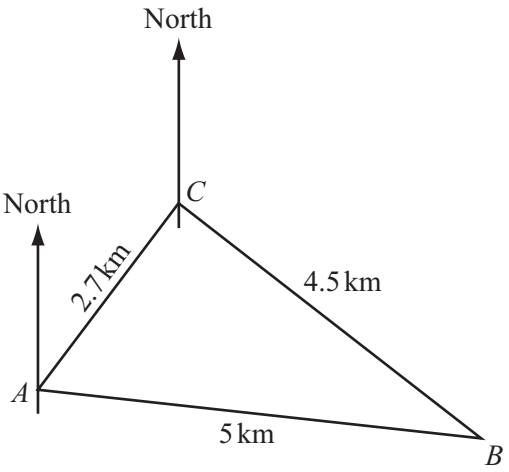

NOT TO SCALE

The diagram shows 3 ships A, B and C at sea.

$AB = 5$ km, $BC = 4.5$ km and $AC = 2.7$ km.

(a) Calculate angle ACB.
Show all your working.

Answer(a) Angle ACB = ... [4]

(b) The bearing of A from C is 220°.

Calculate the bearing of B from C.

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

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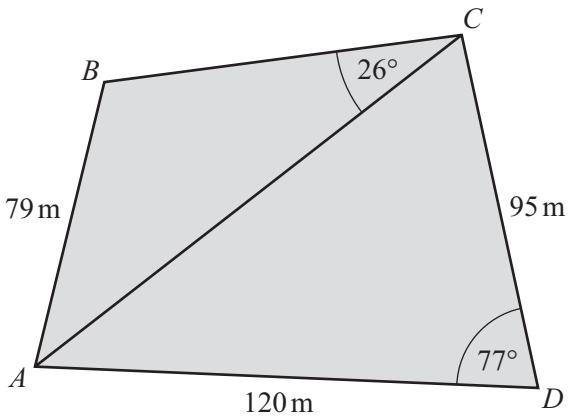

NOT TO SCALE

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]

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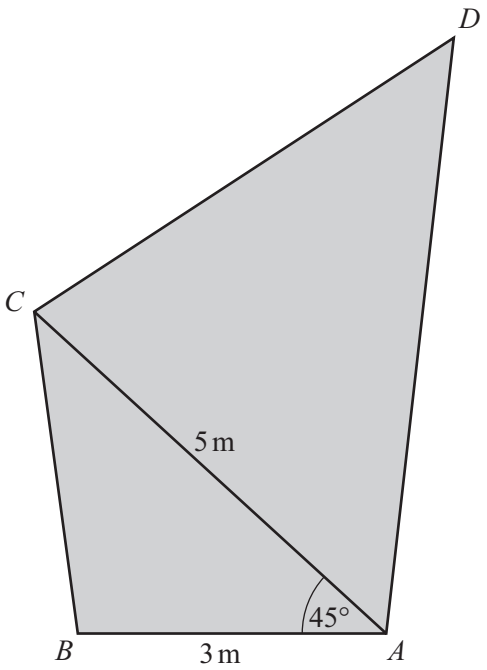


NOT TO SCALE

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.

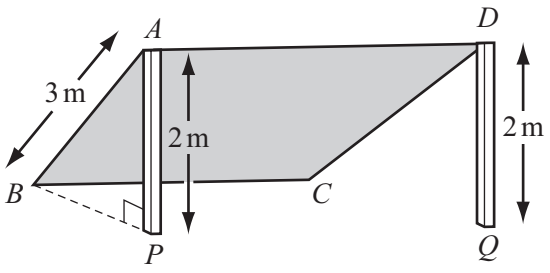
Answer(b)(ii) ..... m^2 [3]

(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]

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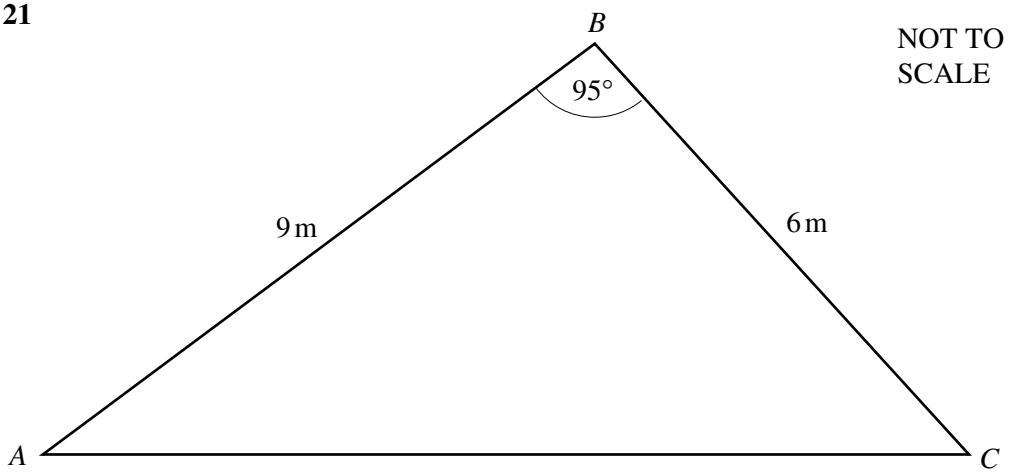


NOT TO SCALE

The triangular area ABC is part of Henri's garden.
$AB = 9$ m, $BC = 6$ m and angle $ABC = 95°$.
Henri puts a fence along AC and plants vegetables in the triangular area ABC.
Calculate

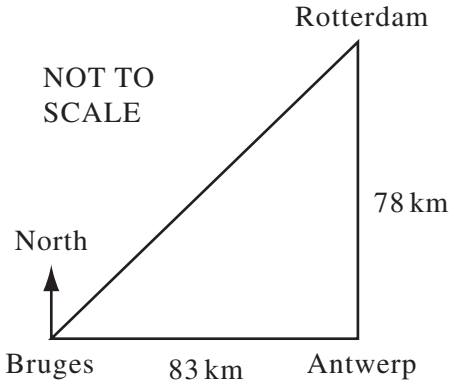
(a) the length of the fence AC,

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

(b) the area for vegetables.

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

18



Antwerp is 78 km due South of Rotterdam and 83 km due East of Bruges, as shown in the diagram.

Calculate

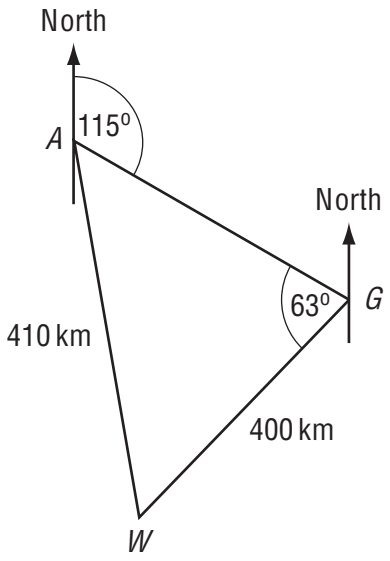
(a) the distance between Bruges and Rotterdam,

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

(b) the bearing of Rotterdam from Bruges, correct to the nearest degree.

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

20 A plane flies from Auckland (A) to Gisborne (G) on a bearing of 115^o.
The plane then flies on to Wellington (W). Angle $AGW = 63^o$.



NOT TO SCALE

(a) Calculate the bearing of Wellington from Gisborne.

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

(b) The distance from Wellington to Gisborne is 400 kilometres.
The distance from Auckland to Wellington is 410 kilometres.

Calculate the bearing of Wellington from Auckland.

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

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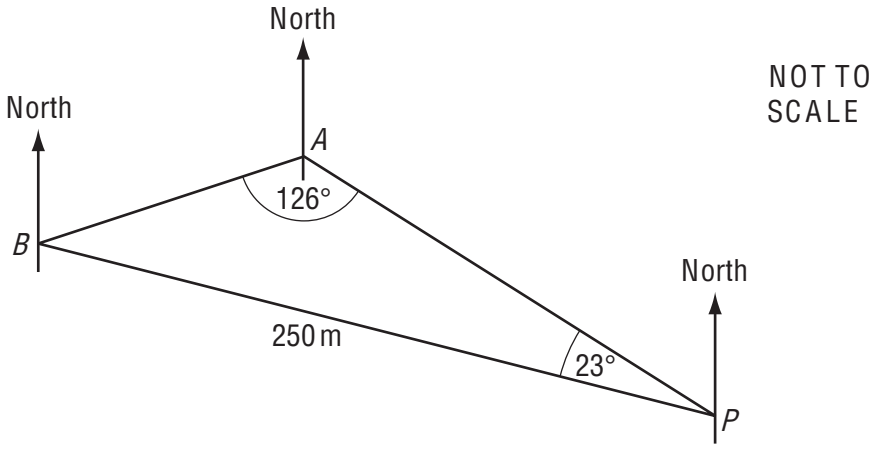


The diagram shows three straight horizontal roads in a town, connecting points P, A and B.

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

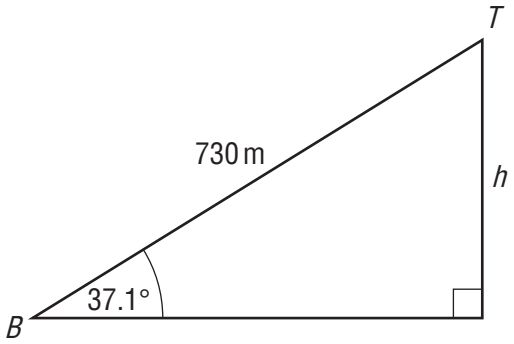
(i) B from P,

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

(ii) A from B.

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

12 The diagram represents the ski lift in Queenstown New Zealand.



(a) The length of the cable from the bottom, B, to the top, T, is 730 metres.

The angle of elevation of T from B is 37.1°.

Calculate the change in altitude, h metres, from the bottom to the top.

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

(b) The lift travels along the cable at 3.65 metres per second.

Calculate how long it takes to travel from B to T.

Give your answer in minutes and seconds.

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

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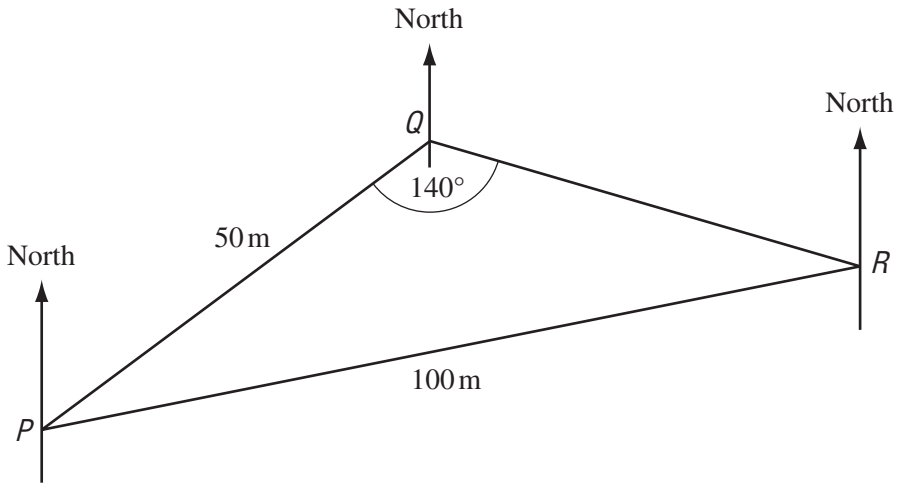

NOT TO SCALE

The diagram shows three points P, Q and R on horizontal ground.

$PQ = 50$ m, $PR = 100$ m and angle $PQR = 140°$.

(a) Calculate angle PRQ.

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

(b) The bearing of R from Q is 100°.

Find the bearing of P from R.

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

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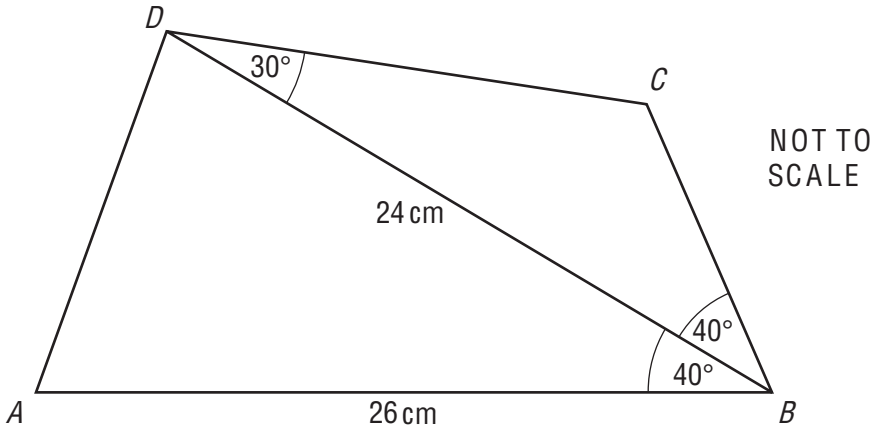

ABCD is a quadrilateral and *BD* is a diagonal.
AB = 26 cm, *BD* = 24 cm, angle *ABD* = 40°, angle *CBD* = 40° and angle *CDB* = 30°.

(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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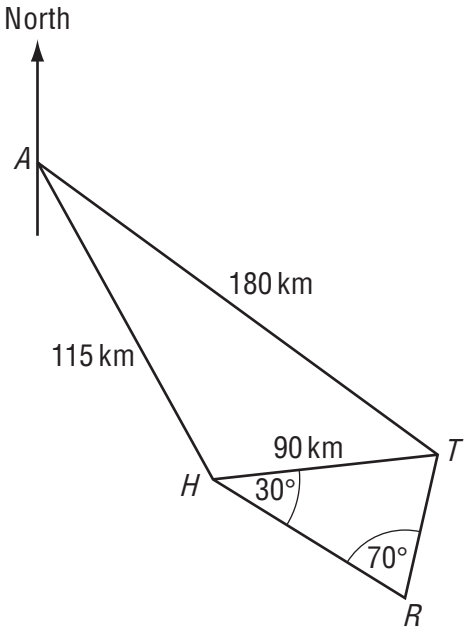

The diagram shows some straight line distances between Auckland (A), Hamilton (H), Tauranga (T) and Rotorua (R).
AT = 180 km, AH = 115 km and HT = 90 km.

(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]

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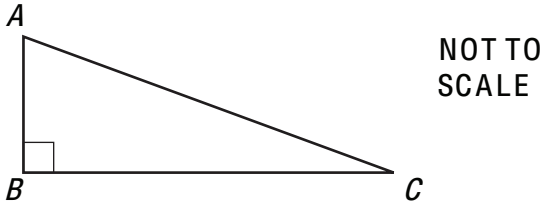
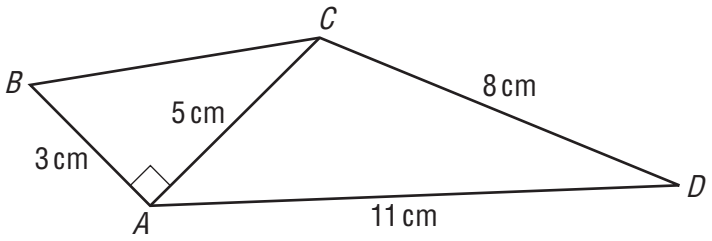
1 In the right-angled triangle ABC, $\cos C = \frac{4}{5}$. Find angle A.



Answer Angle $A =$ ..... [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]

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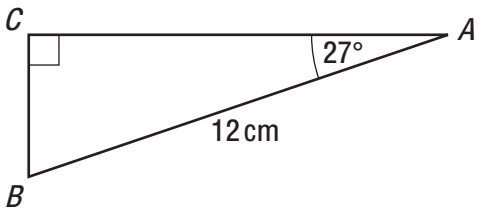

NOT TO SCALE

In triangle ABC, $AB = 12$ cm, angle $C = 90°$ and angle $A = 27°$.
Calculate the length of AC.

Answer $AC =$ ..... cm [2]

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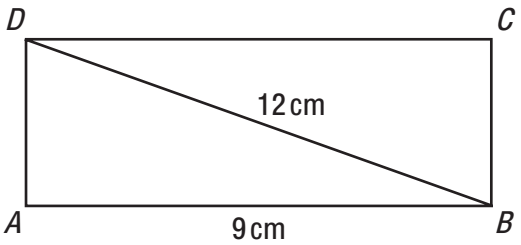

NOT TO SCALE

In the rectangle $ABCD$, $AB = 9$ cm and $BD = 12$ cm.
Calculate the length of the side BC.

Answer $BC =$ ..... cm [3]

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12 **(a)** Write 16 460 000 in standard form.

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

(b) Calculate $7.85 \div (2.366 \times 10^2)$, giving your answer in standard form.

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

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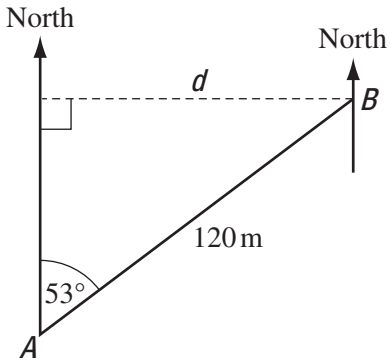
10 (a)



NOT TO SCALE

B is 120 m from *A* on a bearing of 053°.
Calculate

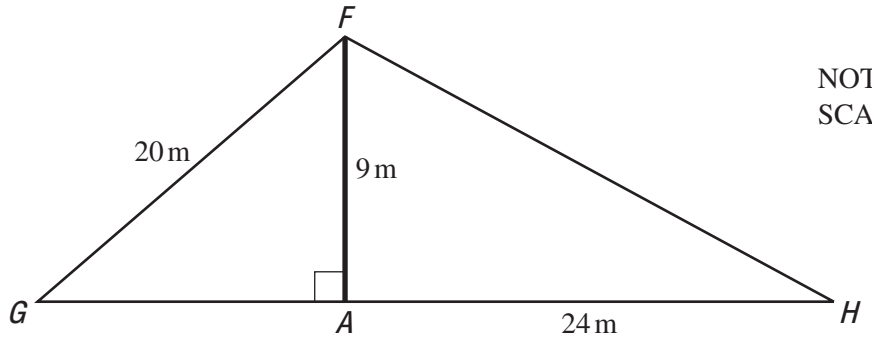
(i) the distance *d*,

Answer(a)(i) *d* = ... m [2]

(ii) the bearing of *A* from *B*.

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

(b)



NOT TO SCALE

A vertical flagpole, *AF*, is 9 m high.
It is held in place by two straight wires *FG* and *FH*.
FG = 20 m and *AH* = 24 m.
G, *A* and *H* lie in a straight line on horizontal ground.
Calculate

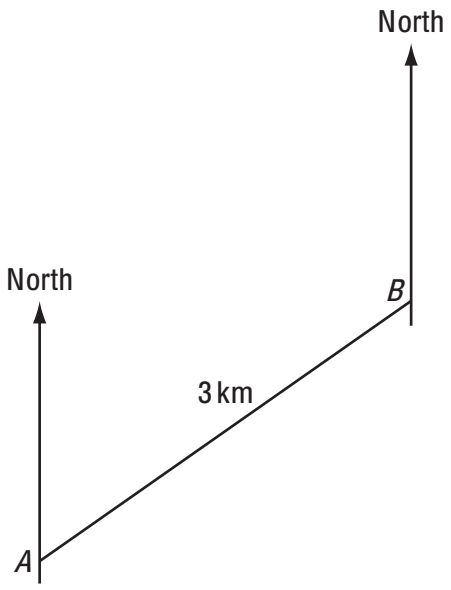
(i) angle *FHA*,

Answer(b)(i) Angle *FHA* = ... [2]

(ii) the distance *GA*.

Answer(b)(ii) *GA* = ... m [3]

8 Manuel rows his boat from *A* to *B*, a distance of 3 kilometres.
The scale diagram below shows his journey.
1 centimetre represents 0.5 kilometres.



(a) (i) Measure the bearing of *B* from *A*.

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

(ii) The journey from *A* to *B* takes him 30 minutes.

Calculate his average speed in kilometres per hour.

Answer(a)(ii) ..... km/h [1]

(b) From *B*, Manuel rows 3.5 kilometres in a straight line, on a bearing of 145°, to a point *C*.

On the diagram, draw accurately this journey and label the point *C*. [2]

(c) Manuel then rows from C to A.

(i) Measure CA.

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

(ii) Work out the **actual** distance from C to A.

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

(iii) By measuring a suitable angle, find the bearing of A from C.

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

(d) Two buoys, P and Q, are on opposite sides of the line AB.
Each buoy is 2 km from A and 1.5 km from B.

(i) On the diagram, construct and mark the positions of P and Q. [2]

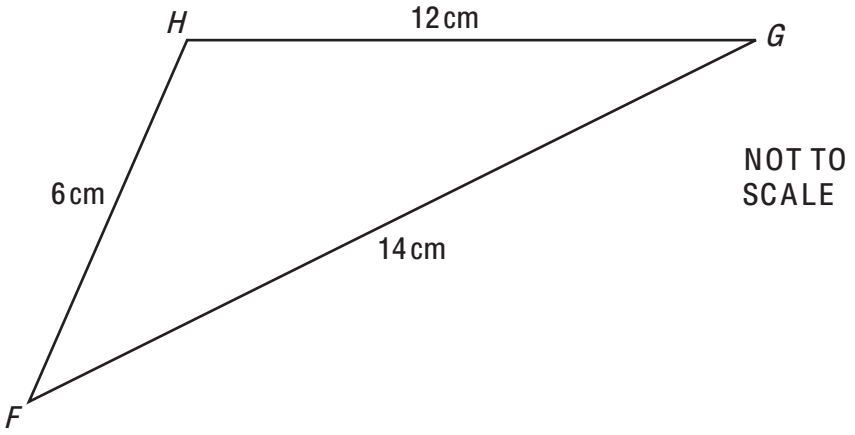
(ii) Measure the distance between P and Q.

Answer(d)(ii) ..... cm [1]

(iii) Find the **actual** distance, PQ, in kilometres.

Answer(d)(iii) ..... km [1]

4 (a)



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

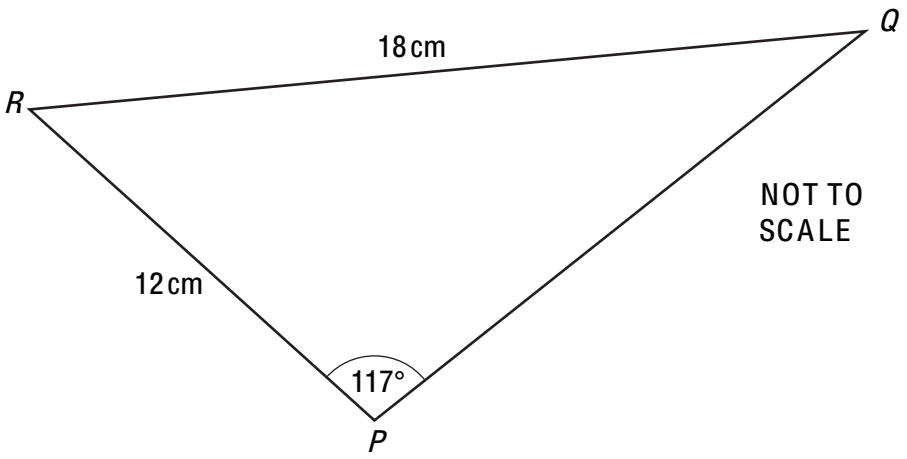
(i) Calculate the size of angle HFG.

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

(ii) Calculate the area of triangle FGH.

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

(b)

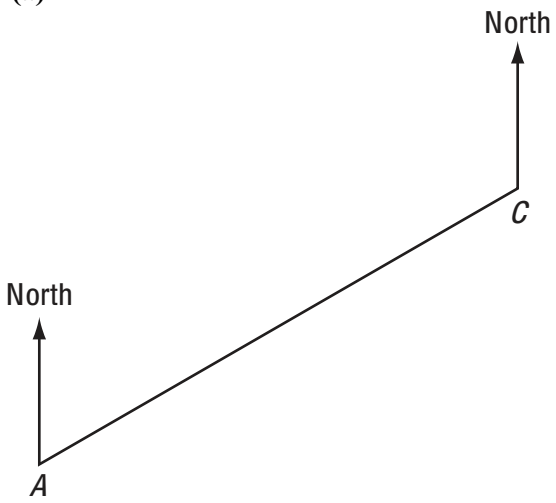


The diagram shows triangle PQR, with $RP = 12$ cm, $RQ = 18$ cm and angle $RPQ = 117°$.

Calculate the size of angle RQP.

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

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.

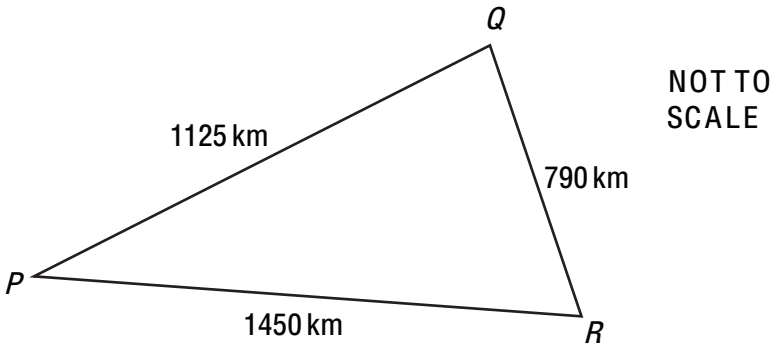
Answer(a)(v) ..... km^2 [2]

(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)

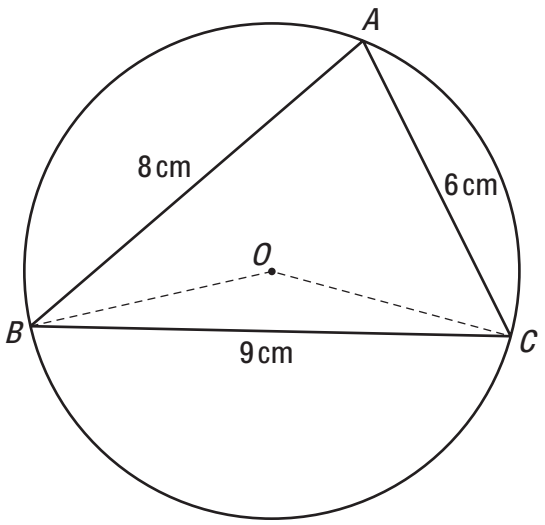


The diagram shows the distances between three towns P, Q and R.

Calculate angle PQR.

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

4



NOT TO SCALE

The circle, centre O, passes through the points A, B and C.

In the triangle ABC, $AB = 8$ cm, $BC = 9$ cm and $CA = 6$ cm.

(a) Calculate angle BAC and show that it rounds to 78.6°, correct to 1 decimal place.

Answer(a)

[4]

(b) M is the midpoint of BC.

(i) Find angle BOM.

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

(ii) Calculate the radius of the circle and show that it rounds to 4.59 cm, correct to 3 significant figures.

Answer(b)(ii)

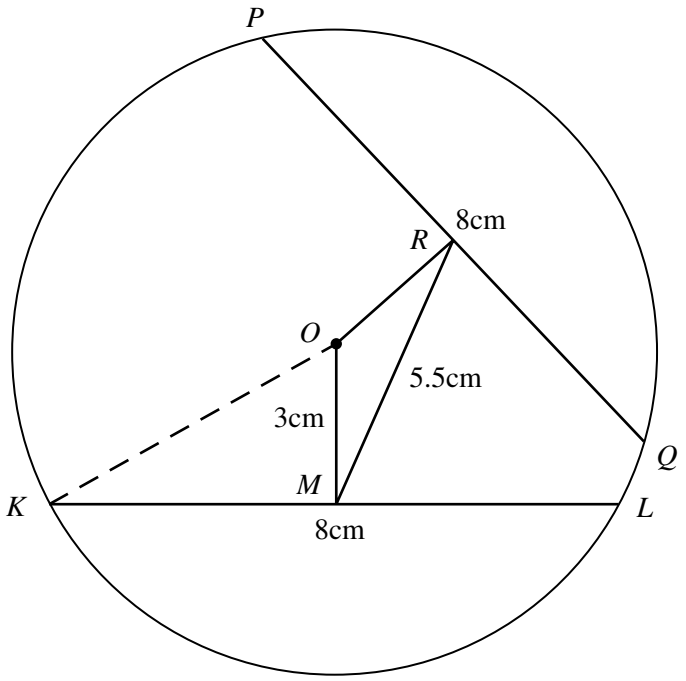
[3]

(c) Calculate the area of the triangle *ABC* as a percentage of the area of the circle.

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

22

NOT TO SCALE



In the circle, centre O, the chords KL and PQ are each of length 8 cm.
M is the mid-point of KL and R is the mid-point of PQ. $OM = 3$ cm.

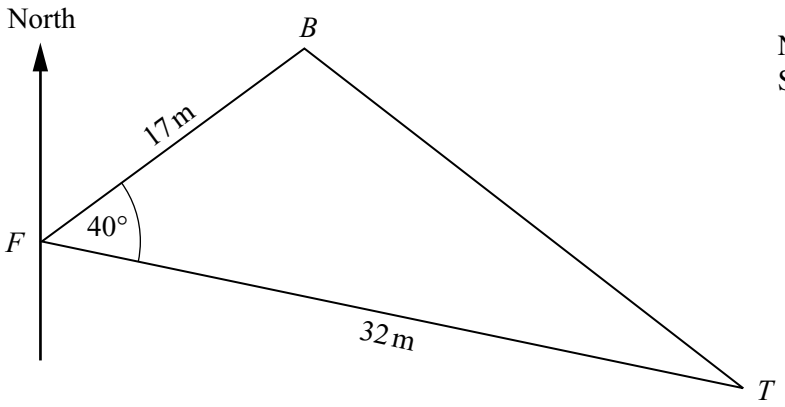
(a) Calculate the length of OK.

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

(b) RM has a length of 5.5 cm. Calculate angle ROM.

Answer (b) Angle $ROM =$ ..... [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]

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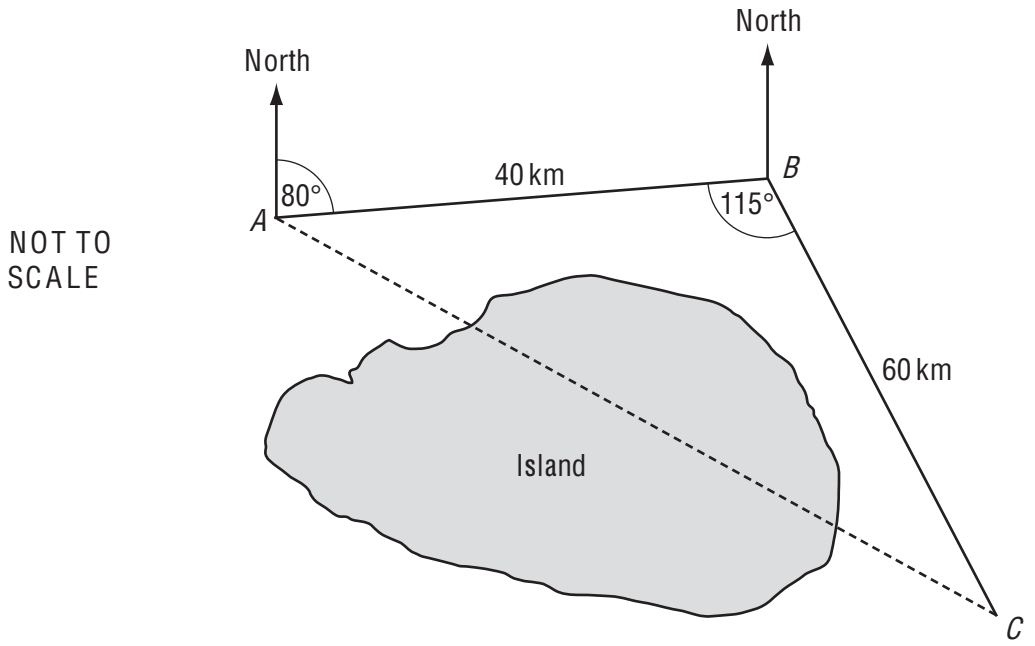


To avoid an island, a ship travels 40 kilometres from A to B and then 60 kilometres from B to C.

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]

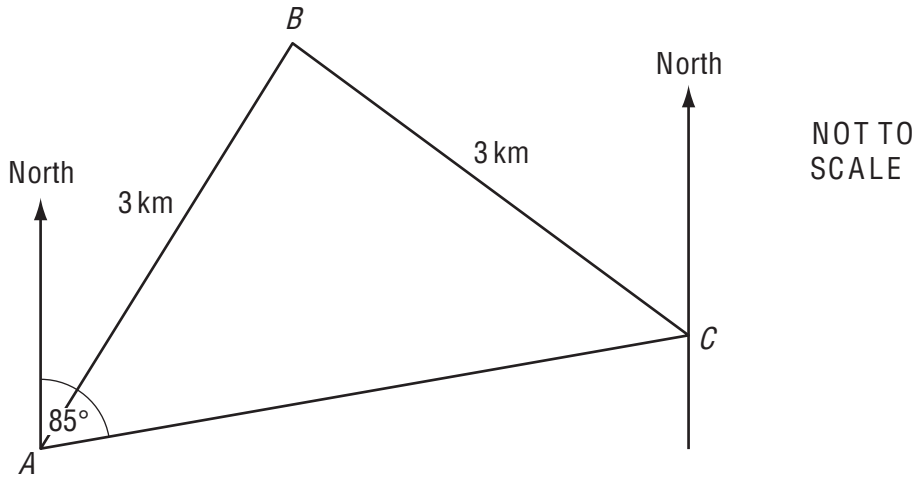
(ii) C from B. [1]

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

(d) Calculate angle BAC. [3]

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

16



A, *B* and *C* are three places in a desert. Tom leaves *A* at 0640 and takes 30 minutes to walk directly to *B*, a distance of 3 kilometres. He then takes an hour to walk directly from *B* to *C*, also a distance of 3 kilometres.

(a) At what time did Tom arrive at *C*?

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

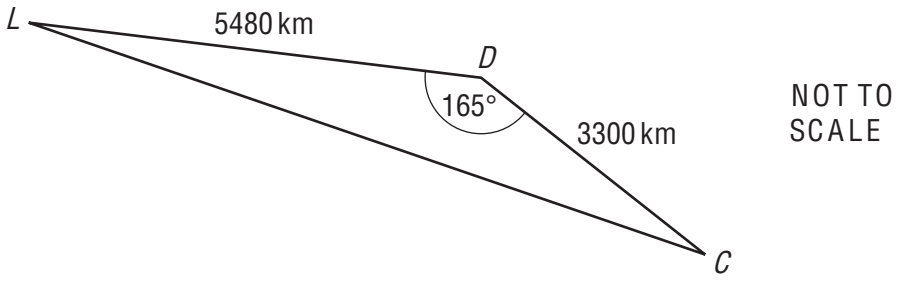
(b) Calculate his average speed for the whole journey.

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

(c) The bearing of *C* from *A* is 085°.
Find the bearing of *A* from *C*.

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

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.

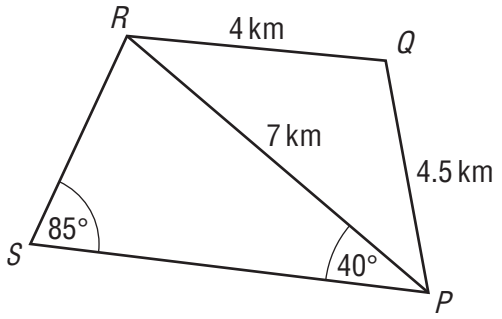
Answer(a)(i)

[4]

(ii) Calculate the angle CLD.

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

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.

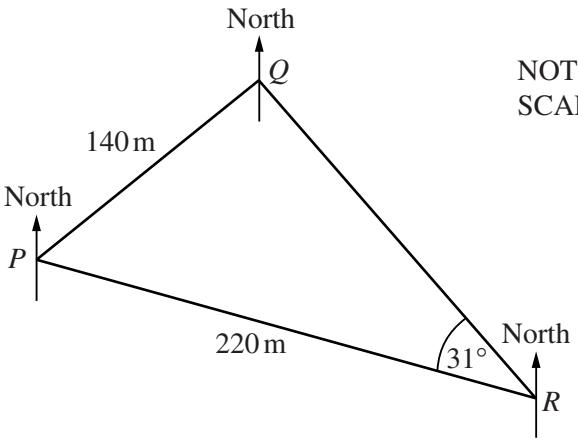
Answer(b)

[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.]

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

21



Theresa swims from P to Q, then from Q to R and then finally returns from R to P.
$PQ = 140$ m, $RP = 220$ m and angle $PRQ = 31°$.

(a) Angle PQR is **obtuse**.
Calculate its size, to the nearest degree.

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

(b) The bearing of Q from P is 060°.
Calculate the bearing of R from Q.

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

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22 $f: x \mapsto 3 - 2x$ and $g: x \mapsto \frac{x+1}{4}$, for all values of x.

(a) Find $f(-\frac{3}{4})$.

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

(b) Find the inverse function, $g^{-1}(x)$.

Answer (b) $g^{-1}(x) =$ ..... [2]

(c) Find the composite function, $fg(x)$, giving your answer as a single fraction.

Answer (c) $fg(x) =$ ..... [2]
