3.5 Sine Rule, Cosine Rule and Area of a Triangle: 2-hour Pack

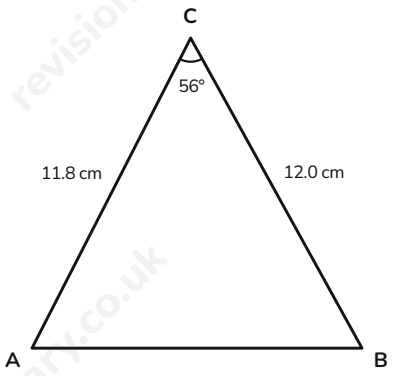
Total Marks

AQA 8365 · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

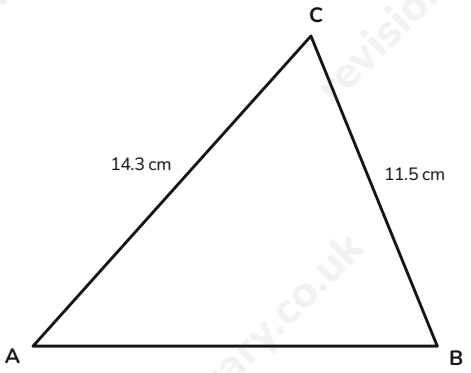
1 In triangle ABC, BC = 12.0 cm, AC = 11.8 cm and angle C = 56 degrees. Calculate the area of the triangle. Give your answer correct to 3 significant figures.



(Total for Question 1 is 3 marks)

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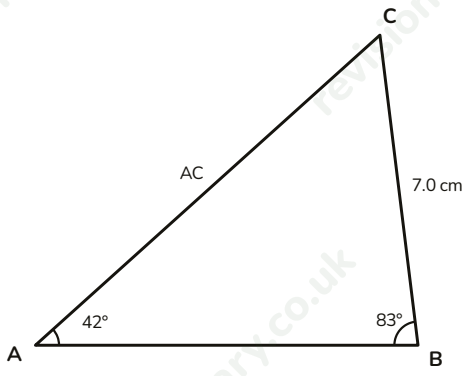
2 In triangle ABC, BC = 11.5 cm, AC = 14.3 cm and the area of the triangle is 73.9 cm². Angle C is acute. Calculate the size of angle C. Give your answer correct to 1 decimal place.



(Total for Question 2 is 3 marks)

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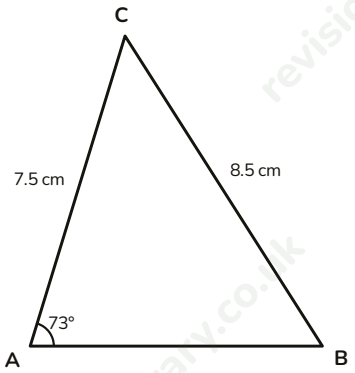
3 In triangle ABC, angle A = 42 degrees, angle B = 83 degrees and BC = 7.0 cm. Calculate the length of AC. Give your answer correct to 3 significant figures.



(Total for Question 3 is 3 marks)

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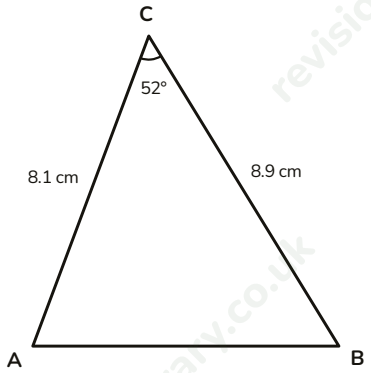
4 In triangle ABC, angle A = 73 degrees, BC = 8.5 cm and AC = 7.5 cm. Angle B is acute. Calculate the size of angle B. Give your answer correct to 1 decimal place.



(Total for Question 4 is 3 marks)

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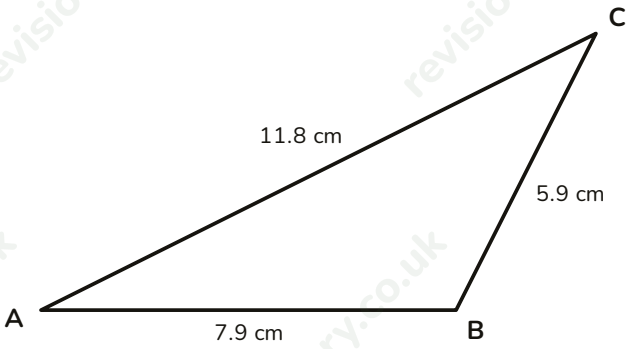
5 In triangle ABC, BC = 8.9 cm, AC = 8.1 cm and angle C = 52 degrees. Calculate the area of the triangle. Give your answer correct to 3 significant figures.



(Total for Question 5 is 3 marks)

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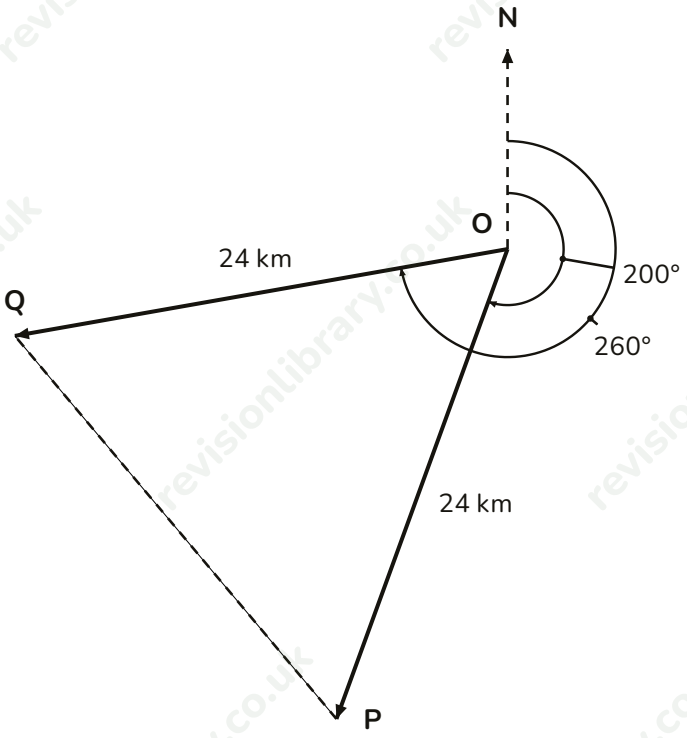
6 In triangle ABC, AB = 7.9 cm, AC = 11.8 cm and BC = 5.9 cm. Calculate the size of angle A. Give your answer correct to 1 decimal place.



(Total for Question 6 is 3 marks)

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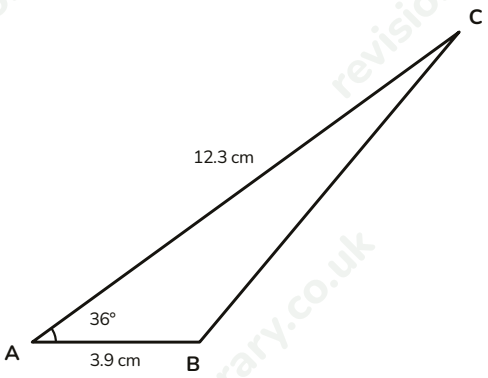
7 A ship leaves port O. Ship P sails 24 km on a bearing of 200 degrees. Ship Q sails 24 km on a bearing of 260 degrees. Calculate the distance between the two ships. Give your answer correct to 3 significant figures.



(Total for Question 7 is 4 marks)

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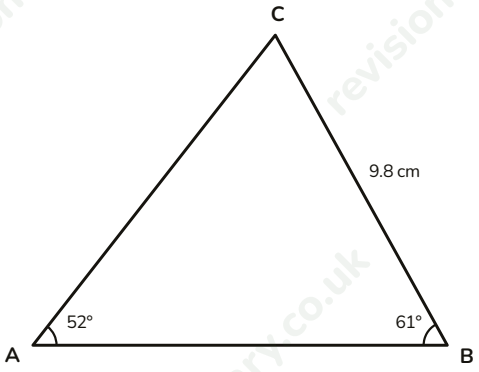
8 In triangle ABC, AB = 3.9 cm, AC = 12.3 cm and angle A = 36 degrees. Calculate the length of BC. Give your answer correct to 3 significant figures.



(Total for Question 8 is 3 marks)

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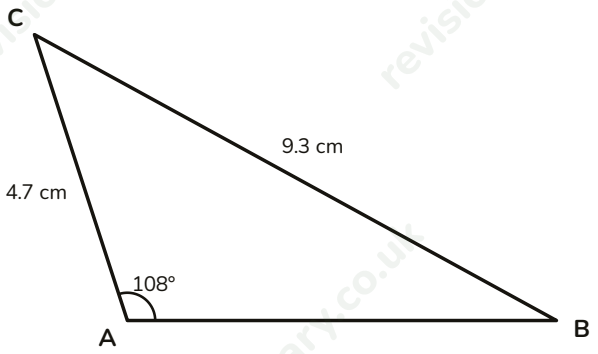
9 In triangle ABC, angle A = 52 degrees, angle B = 61 degrees and BC = 9.8 cm. Calculate the length of AC. Give your answer correct to 3 significant figures.



(Total for Question 9 is 3 marks)

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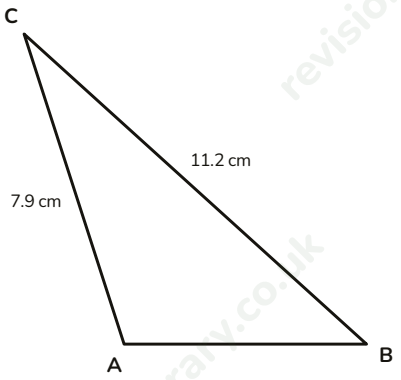
10 In triangle ABC, angle A = 108 degrees, BC = 9.3 cm and AC = 4.7 cm. Angle B is acute. Calculate the size of angle B. Give your answer correct to 1 decimal place.



(Total for Question 10 is 3 marks)

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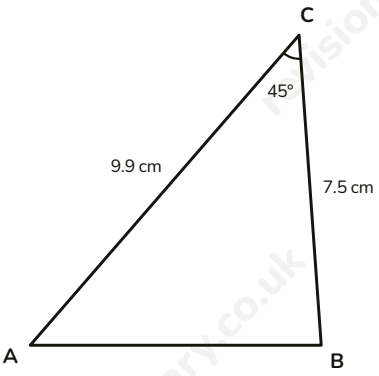
11 In triangle ABC, BC = 11.2 cm, AC = 7.9 cm and the area of the triangle is 22.1 cm². Angle C is acute. Calculate the size of angle C. Give your answer correct to 1 decimal place.



(Total for Question 11 is 3 marks)

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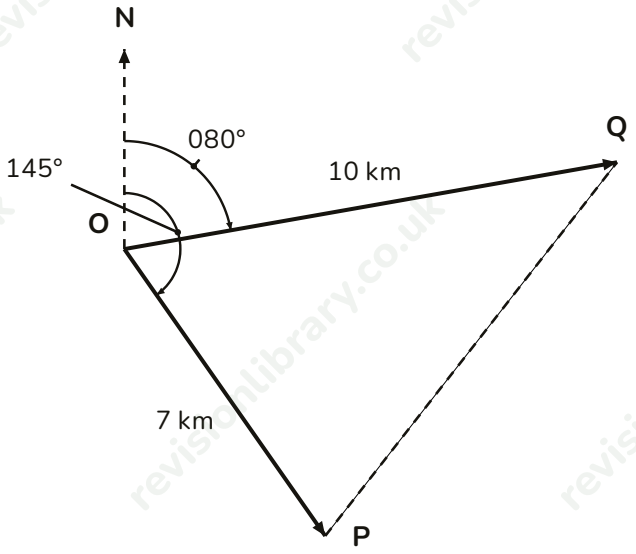
12 In triangle ABC, BC = 7.5 cm, AC = 9.9 cm and angle C = 45 degrees. Calculate the area of the triangle. Give your answer correct to 3 significant figures.



(Total for Question 12 is 3 marks)

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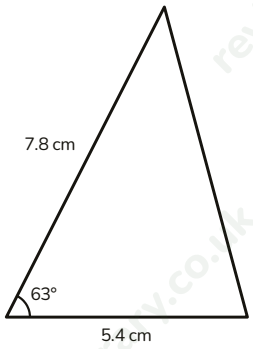
13 A ship leaves port O. Ship P sails 7 km on a bearing of 145 degrees. Ship Q sails 10 km on a bearing of 080 degrees. Calculate the distance between the two ships. Give your answer correct to 3 significant figures.



(Total for Question 13 is 4 marks)

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14 A triangle has two sides of length 5.4 cm and 7.8 cm, with an included angle of 63 degrees between them.



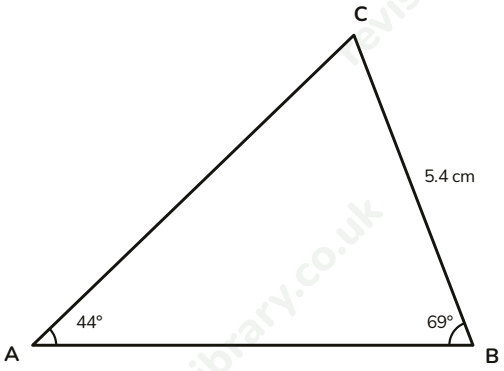
(a) Calculate the area of the triangle, giving your answer correct to 3 significant figures. **(2)**

.....

(Total for Question 14 is 2 marks)

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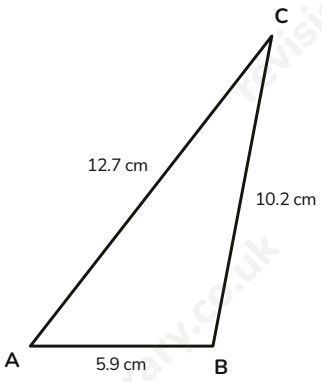
15 In triangle ABC, angle A = 44 degrees, angle B = 69 degrees and BC = 5.4 cm. Calculate the length of AC. Give your answer correct to 3 significant figures.



(Total for Question 15 is 3 marks)

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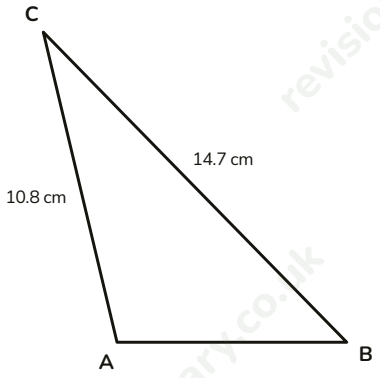
16 In triangle ABC, AB = 5.9 cm, AC = 12.7 cm and BC = 10.2 cm. Calculate the size of angle A. Give your answer correct to 1 decimal place.



(Total for Question 16 is 3 marks)

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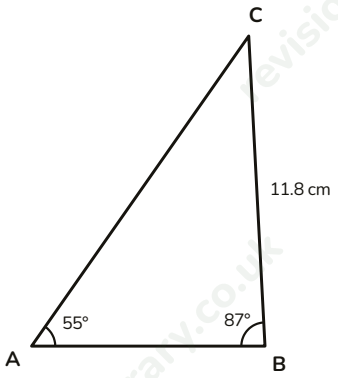
17 In triangle ABC, BC = 14.7 cm, AC = 10.8 cm and the area of the triangle is 40.9 cm². Angle C is acute. Calculate the size of angle C. Give your answer correct to 1 decimal place.



(Total for Question 17 is 3 marks)

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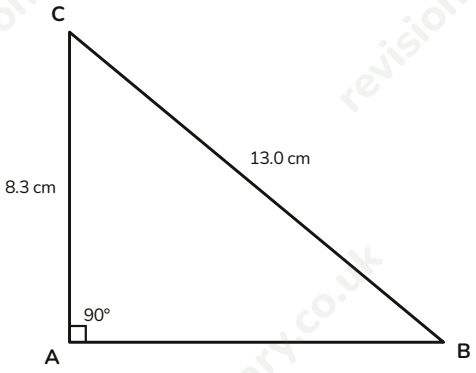
18 In triangle ABC, angle A = 55 degrees, angle B = 87 degrees and BC = 11.8 cm. Calculate the length of AC. Give your answer correct to 3 significant figures.



(Total for Question 18 is 3 marks)

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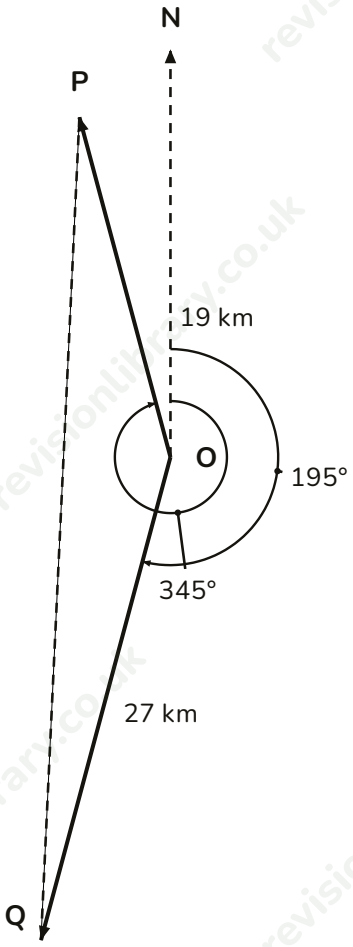
19 In triangle ABC, angle A = 90 degrees, BC = 13.0 cm and AC = 8.3 cm. Angle B is acute. Calculate the size of angle B. Give your answer correct to 1 decimal place.



(Total for Question 19 is 3 marks)

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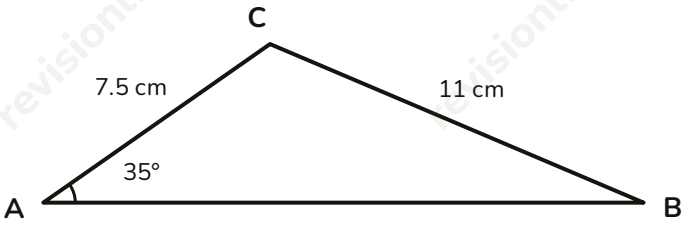
20 A ship leaves port O. Ship P sails 19 km on a bearing of 345 degrees. Ship Q sails 27 km on a bearing of 195 degrees. Calculate the distance between the two ships. Give your answer correct to 3 significant figures.



(Total for Question 20 is 4 marks)

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21 In triangle ABC, angle A = 35 degrees, side a = 11 cm and side b = 7.5 cm.



(a) Calculate angle B, giving your answer correct to 1 decimal place. **(3)**

.....

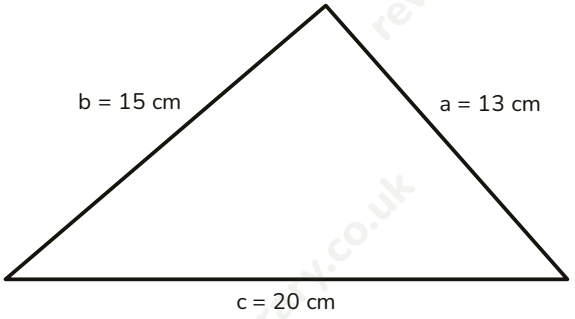
(b) Hence calculate angle C. **(1)**

.....

(Total for Question 21 is 4 marks)

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22 A triangle has sides a = 13 cm, b = 15 cm and c = 20 cm.



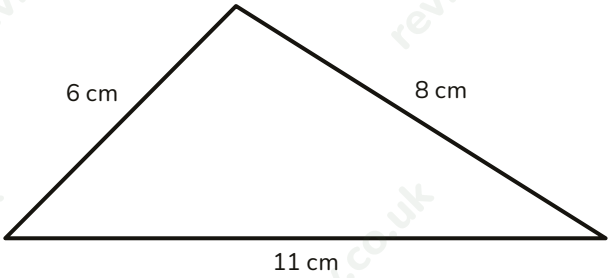
(a) Calculate the size of the largest angle of the triangle, giving your answer correct to 1 decimal place. **(3)**

.....

(Total for Question 22 is 3 marks)

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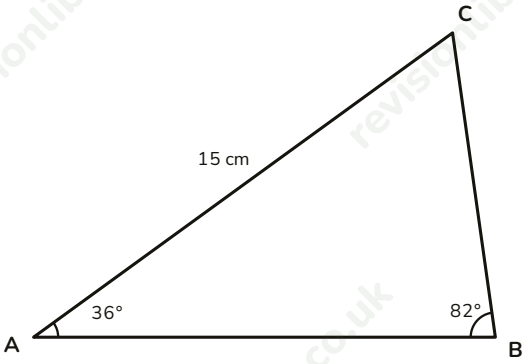
23 In triangle ABC, a = 8 cm, b = 6 cm and c = 11 cm, where angle C is opposite side c. Calculate the size of angle C, giving your answer correct to 1 decimal place.



(Total for Question 23 is 2 marks)

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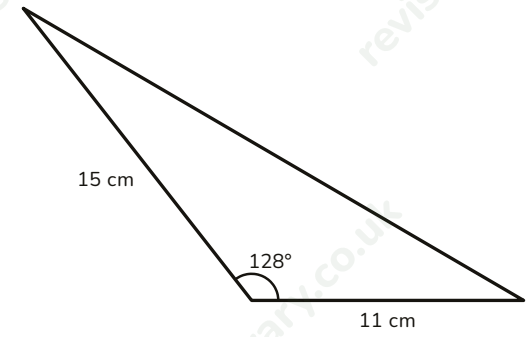
24 In triangle ABC, angle A = 36 degrees, angle B = 82 degrees and side b = 15 cm (opposite angle B). Calculate side a (opposite angle A), giving your answer correct to 3 significant figures.



(Total for Question 24 is 3 marks)

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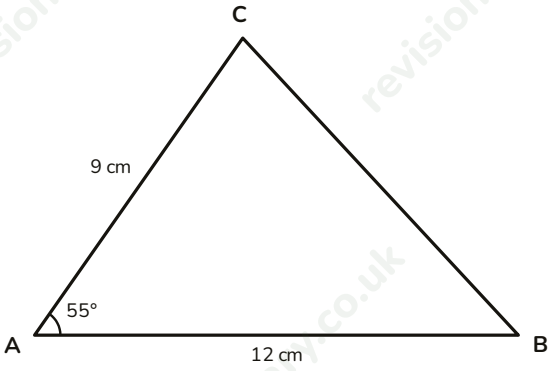
25 A triangle has two sides of length 11 cm and 15 cm with an included angle of 128 degrees. Calculate the length of the third side, giving your answer correct to 3 significant figures.



(Total for Question 25 is 3 marks)

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26 In triangle ABC, b = 9 cm, c = 12 cm and the included angle A = 55 degrees. Calculate side a, giving your answer correct to 3 significant figures.

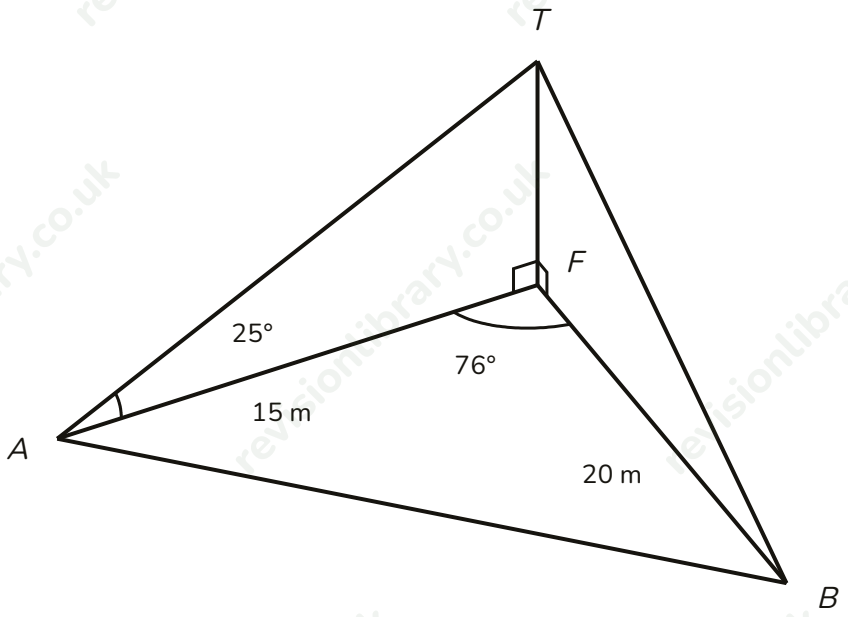


(Total for Question 26 is 2 marks)

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27 A vertical flagpole TF stands on horizontal ground at foot F. Points A and B lie on the ground such that angle AFB = 76 degrees, FA = 15 m and FB = 20 m. The angle of elevation of the top T of the flagpole from A is 25 degrees.

Diagram NOT accurately drawn



(a) Calculate the height TF of the flagpole, giving your answer correct to 3 significant figures. **(2)**

.....

(b) Calculate the distance AB, giving your answer correct to 3 significant figures. **(3)**

.....

(c) Calculate the angle of elevation of T from B, giving your answer correct to 1 decimal place. **(2)**

.....

(Total for Question 27 is 7 marks)

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28 A triangular field has two sides of length 45 m and 60 m, with an angle of 72 degrees between them. A path runs along the third side of the field.

(a) Calculate the length of the path (the third side of the field), giving your answer correct to 3 significant figures. **(2)**

.....

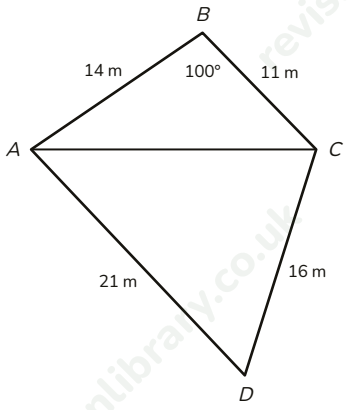
(b) Calculate the area of the field, giving your answer correct to 3 significant figures. **(2)**

.....

(Total for Question 28 is 4 marks)

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29 A field is in the shape of quadrilateral ABCD. AB = 14 m, BC = 11 m, angle ABC = 100 degrees, CD = 16 m and DA = 21 m. The diagonal AC divides the field into triangles ABC and ACD.



(a) Calculate the length of the diagonal AC, giving your answer correct to 3 significant figures. **(3)**

.....

(b) Calculate the size of angle ADC, giving your answer correct to 1 decimal place. **(3)**

.....

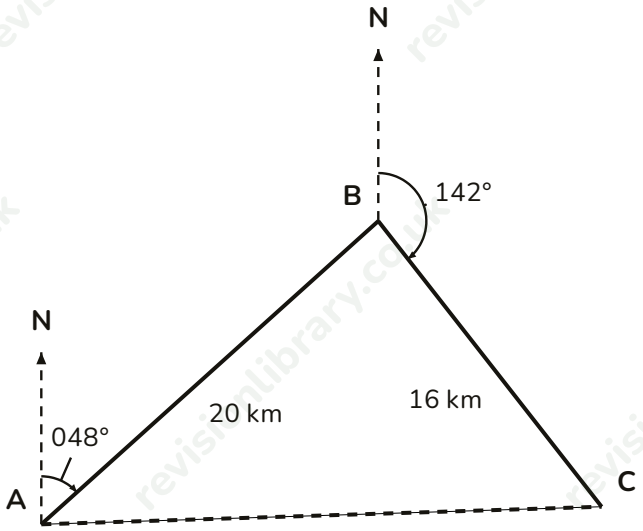
(c) Hence calculate the total area of the quadrilateral field ABCD, giving your answer correct to 3 significant figures. **(4)**

.....

(Total for Question 29 is 10 marks)

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30 A cargo ship sails from harbour A on a bearing of 048 degrees for a distance of 20 km to reach point B. At B, the ship changes course and sails on a bearing of 142 degrees for a distance of 16 km to reach point C.



(a) Show that angle ABC = 86 degrees. **(1)**

(b) Calculate the distance AC, giving your answer correct to 3 significant figures. **(2)**

.....

(c) Find the bearing of C from A, giving your answer to the nearest degree. **(2)**

.....

(Total for Question 30 is 5 marks)

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Mark scheme · 3.5 Sine Rule, Cosine Rule and Area of a Triangle: 2-hour Pack

Question 1

1/2 x 12.0 x 11.8 x sin 56	**M1**
58.696 or better	**A1**
58.7 cm² cao	**A1**

Answer: 58.7 cm^2

Question 2

1/2 x 11.5 x 14.3 x sin C = 73.9	**M1**
sin C = 0.8988	**M1**
64.0 degrees cao	**A1**

Answer: 64.0 degrees

Question 3

AC / sin B = BC / sin A or equivalent	**M1**
AC = 7.0 x sin 83 / sin 42	**M1**
10.4 cm cao	**A1**

Answer: 10.4 cm

Question 4

sin B / AC = sin A / BC or equivalent	**M1**
sin B = 7.5 x sin 73 / 8.5	**M1**
57.5 degrees cao	**A1**

Answer: 57.5 degrees

Question 5

1/2 x 8.9 x 8.1 x sin 52	**M1**
28.404 or better	**A1**
28.4 cm² cao	**A1**

Answer: 28.4 cm^2

Question 6

cos A = $(11.8^2 + 7.9^2 - 5.9^2) / (2 \times 11.8 \times 7.9)$	**M1**
cos A = 0.8949	**M1**
26.5 degrees cao	**A1**

Answer: 26.5 degrees

Question 7

angle POQ = 60 degrees	**B1**
$PQ^2 = 24^2 + 24^2 - 2 \times 24 \times 24 \times \cos 60$	**M1**
square root taken	**M1**
24.0 km cao	**A1**

Answer: 24.0 km

Question 8

$BC^2 = 3.9^2 + 12.3^2 - 2 \times 3.9 \times 12.3 \times \cos 36$	**M1**
BC^2 = 88.88 (or a correct evaluation)	**M1**
9.43 cm cao	**A1**

Answer: 9.43 cm

Question 9

AC / sin B = BC / sin A or equivalent	**M1**
AC = 9.8 x sin 61 / sin 52	**M1**
10.9 cm cao	**A1**

Answer: 10.9 cm

Question 10

sin B / AC = sin A / BC or equivalent	**M1**
sin B = 4.7 x sin 108 / 9.3	**M1**
28.7 degrees cao	**A1**

Answer: 28.7 degrees

Question 11

1/2 x 11.2 x 7.9 x sin C = 22.1	**M1**
sin C = 0.4995	**M1**
30.0 degrees cao	**A1**

Answer: 30.0 degrees

Question 12

1/2 x 7.5 x 9.9 x sin 45	**M1**
26.251 or better	**A1**
26.3 cm² cao	**A1**

Answer: 26.3 cm^2

Question 13

angle POQ = 65 degrees	**B1**
$PQ^2 = 7^2 + 10^2 - 2 \times 7 \times 10 \times \cos 65$	**M1**
square root taken	**M1**
9.48 km cao	**A1**

Answer: 9.48 km

Question 14

(a) Area = 1/2 * 5.4 * 7.8 * sin(63)	**M1**
(a) 18.8 cm² awrt	**A1**

(a) Answer: 18.8 cm^2

Question 15

AC / sin B = BC / sin A or equivalent	**M1**
AC = 5.4 x sin 69 / sin 44	**M1**
7.26 cm cao	**A1**

Answer: 7.26 cm

Question 16

cos A = $(12.7^2 + 5.9^2 - 10.2^2) / (2 \times 12.7 \times 5.9)$	**M1**
cos A = 0.6143	**M1**
52.1 degrees cao	**A1**

Answer: 52.1 degrees

Question 17

1/2 x 14.7 x 10.8 x sin C = 40.9	**M1**
sin C = 0.5152	**M1**
31.0 degrees cao	**A1**

Answer: 31.0 degrees

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Question 18

AC / sin B = BC / sin A or equivalent	**M1**
AC = 11.8 x sin 87 / sin 55	**M1**
14.4 cm cao	**A1**

Answer: 14.4 cm

Question 19

sin B / AC = sin A / BC or equivalent	**M1**
sin B = 8.3 x sin 90 / 13.0	**M1**
39.7 degrees cao	**A1**

Answer: 39.7 degrees

Question 20

angle POQ = 150 degrees	**B1**
$PQ^2 = 19^2 + 27^2$ - 2 x 19 x 27 x cos 150	**M1**
square root taken	**M1**
44.5 km cao	**A1**

Answer: 44.5 km

Question 21

(a) correct sine rule setup sin(B)/7.5 = sin(35)/11 oe	**M1**
(a) sin(B) = 7.5*sin(35)/11 = 0.391 (awrt)	**M1**
(a) B = 23.0 degrees awrt	**A1**

(a) Answer: B = 23.0 degrees

(b) C = 180 - 35 - 23.0 = 122.0 degrees ft from part (a)	**B1**

(b) Answer: C = 122.0 degrees

Question 22

(a) identify that the largest angle, C, is opposite the longest side, c = 20	**M1**
(a) correct rearranged cosine rule: cos(C) = $(13^2 + 15^2 - 20^2)/(2*13*15)$ oe	**M1**
(a) C = 90.9 degrees awrt	**A1**

(a) Answer: C = 90.9 degrees

Question 23

correct rearranged cosine rule cos(C) = $(8^2 + 6^2 - 11^2)/(2*8*6)$ oe	**M1**
102.6 degrees awrt	**A1**

Answer: 102.6 degrees

Question 24

correct sine rule stated: a/sin(A) = b/sin(B)	**M1**
correct substitution: a = 15*sin(36)/sin(82)	**M1**
8.90 cm awrt	**A1**

Answer: 8.90 cm

Question 25

correct substitution $x^2 = 11^2 + 15^2$ - 2(11)(15)cos(128)	**M1**
x^2 = 346 - 330*(-0.61566) = 549 (awrt) oe	**M1**
23.4 cm awrt	**A1**

Answer: 23.4 cm

Question 26

correct substitution $a^2 = 9^2 + 12^2$ - 2(9)(12)cos(55)	**M1**
10.1 cm awrt	**A1**

Answer: 10.1 cm

Question 27

(a) TF = FA*tan(25) = 15*tan(25) oe	**M1**
(a) TF = 6.99 m awrt	**A1**

(a) Answer: 6.99 m

(b) correct substitution $AB^2 = 15^2 + 20^2$ - 2(15)(20)cos(76)	**M1**
(b) = 625 - 600*0.24192 = 480 (awrt) oe	**M1**
(b) AB = 21.9 m awrt	**A1**

(b) Answer: 21.9 m

(c) tan(angle) = TF/FB = 6.9946/20, ft from part (a)	**M1**
(c) 19.3 degrees awrt	**A1**

(c) Answer: 19.3 degrees

Question 28

(a) correct substitution $x^2 = 45^2 + 60^2$ - 2(45)(60)cos(72)	**M1**
(a) 62.9 m awrt	**A1**

(a) Answer: 62.9 m

(b) Area = 1/2 * 45 * 60 * sin(72)	**M1**
(b) 1280 m² awrt (3sf)	**A1**

(b) Answer: 1280 m^2

Question 29

(a) correct substitution $AC^2 = 14^2 + 11^2$ - 2(14)(11)cos(100)	**M1**
(a) = 317 - 308*(-0.17365) = 370 (awrt) oe	**M1**
(a) AC = 19.2 m awrt	**A1**

(a) Answer: 19.2 m

(b) correct rearranged cosine rule in triangle ACD: cos(ADC) = $(16^2 + 21^2 - AC^2)/(2*16*21)$, ft from part (a)	**M1**
(b) cos(ADC) = (697-370.48)/672 = 0.486 (awrt)	**M1**
(b) ADC = 60.9 degrees awrt	**A1**

(b) Answer: 60.9 degrees

(c) Area of ABC = 1/2 * 14 * 11 * sin(100) = 75.8 (awrt), ft	**M1**
(c) Area of ACD = 1/2 * 16 * 21 * sin(60.9), ft from part (b)	**M1**
(c) Area of ACD = 168*sin(60.9) = 147 (awrt) oe	**M1**
(c) total area = 75.8 + 146.9 = 223 m² awrt	**A1**

(c) Answer: 223 m^2

Question 30

(a) back bearing from B to A = 048 + 180 = 228; angle ABC = 228 - 142 = 86, cso	**B1**

(a) Answer: 86 degrees (shown)

(b) correct substitution $AC^2 = 20^2 + 16^2$ - 2(20)(16)cos(86), ft from part (a)	**M1**
(b) 24.7 km awrt	**A1**

(b) Answer: 24.7 km

(c) correct sine rule setup sin(BAC)/16 = sin(86)/24.7, ft from part (b), giving angle BAC = 40.2 (awrt)	**M1**
(c) 088 degrees awrt (using 048 + 40.2)	**A1**

(c) Answer: 088 degrees

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