HIGHER

3.2 The Sine Rule, Cosine Rule and Area of a Triangle: Test Pack

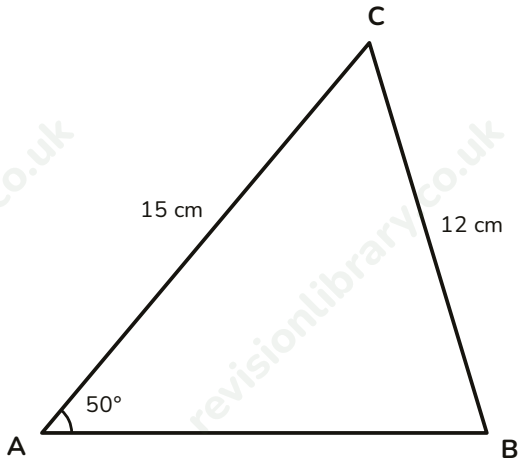
Total Marks

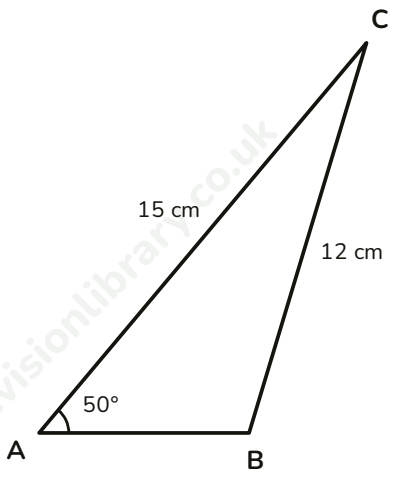
EDEXCEL 4MA1 · Calculator allowed · about 65 minutes

Name: _____ Date: ____ / ____ / _____

Show full working for multi-step questions. Write answers in clear sentences for questions where a reason is asked. Suggested time 65 minutes.

1 In triangle ABC (not right-angled) angle A = 50 degrees, side a = BC = 12 cm and side b = AC = 15 cm. Use the sine rule to find the possible value(s) of angle B in degrees, giving answers to the nearest degree. State if two values are possible.





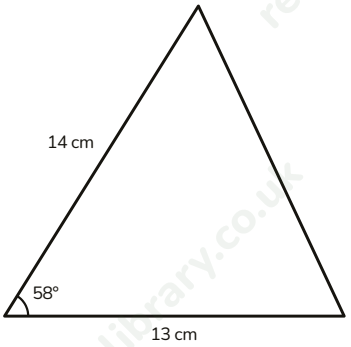
(Total for Question 1 is 2 marks)

2 In triangle ABC, a = BC = 10 cm and angle A = 30 degrees. No other sides or angles are given. State briefly whether the sine rule can be used to find side b = AC uniquely, and explain if an ambiguous case may arise.

(Total for Question 2 is 1 mark)

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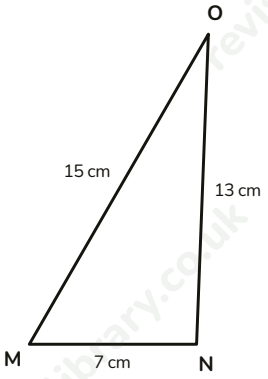
3 A triangle has two sides of lengths 13 cm and 14 cm with included angle 58 degrees between them. Work out the area of this triangle in square centimetres, correct to 1 decimal place, using the area formula Area = 1/2 ab sin C.



(Total for Question 3 is 3 marks)

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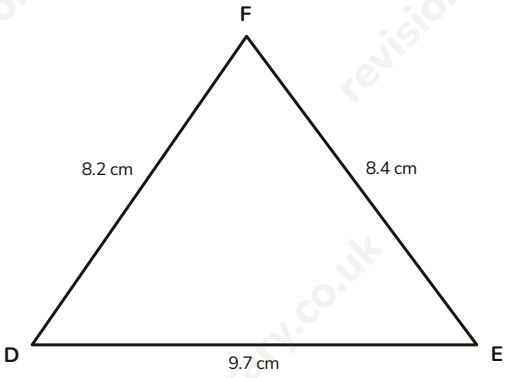
4 Show that for triangle MNO with sides MN = 7 cm, NO = 13 cm and MO = 15 cm, the angle at N is obtuse. Use the cosine rule and give the angle to the nearest degree.



(Total for Question 4 is 2 marks)

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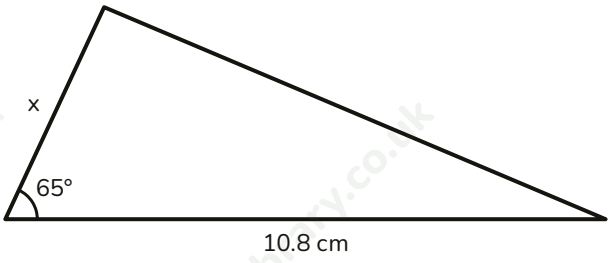
5 Triangle DEF has EF = 8.4 cm, DF = 8.2 cm and DE = 9.7 cm.
Work out the area of the triangle. Give your answer to 1 decimal place.



(Total for Question 5 is 4 marks)

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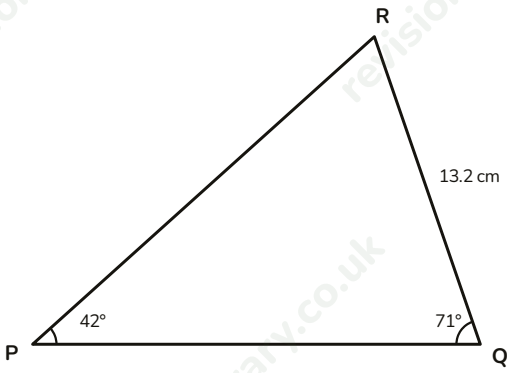
6 A triangle has sides of length 10.8 cm and x cm with an angle of 65 degrees between them. Its area is 20.6 cm².
Calculate the value of x. Give your answer to 1 decimal place.



(Total for Question 6 is 3 marks)

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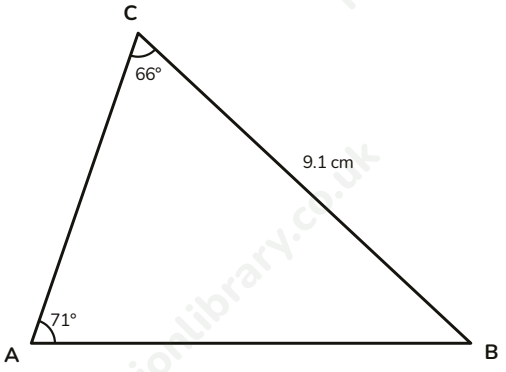
7 In triangle PQR, angle P = 42 degrees, angle Q = 71 degrees and QR = 13.2 cm.
Calculate the area of the triangle. Give your answer to 1 decimal place.



(Total for Question 7 is 5 marks)

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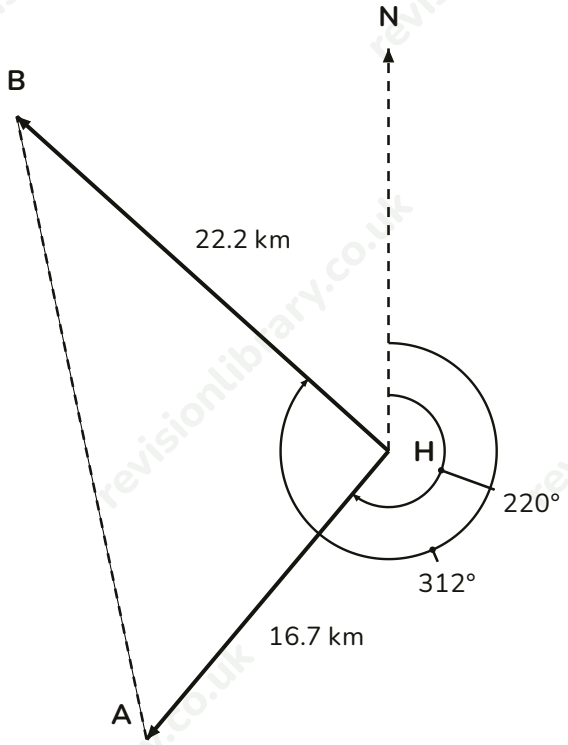
8 In triangle ABC, angle A = 71 degrees, angle C = 66 degrees and BC = 9.1 cm.
Calculate the length of AC. Give your answer to 1 decimal place.



(Total for Question 8 is 3 marks)

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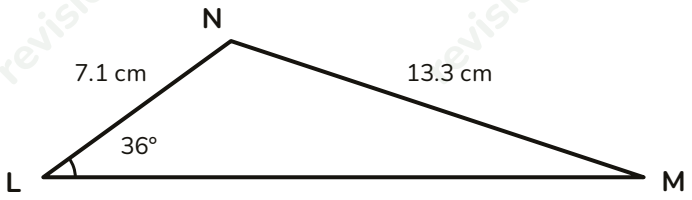
9 Two boats leave a harbour H at the same time. Boat A sails 16.7 km on a bearing of 220 degrees. Boat B sails 22.2 km on a bearing of 312 degrees.
Calculate the bearing of B from A. Give your answer to the nearest degree.



(Total for Question 9 is 5 marks)

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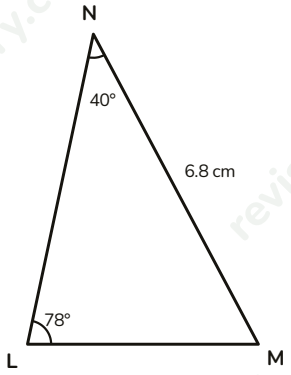
10 In triangle LMN, angle L = 36 degrees, MN = 13.3 cm and LN = 7.1 cm.
Calculate the size of angle M, given that it is acute. Give your answer to 1 decimal place.



(Total for Question 10 is 3 marks)

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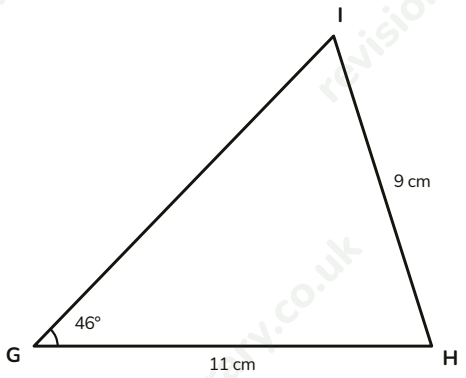
11 In triangle LMN, angle L = 78 degrees, angle N = 40 degrees and MN = 6.8 cm.
Calculate the length of LN. Give your answer to 1 decimal place.



(Total for Question 11 is 3 marks)

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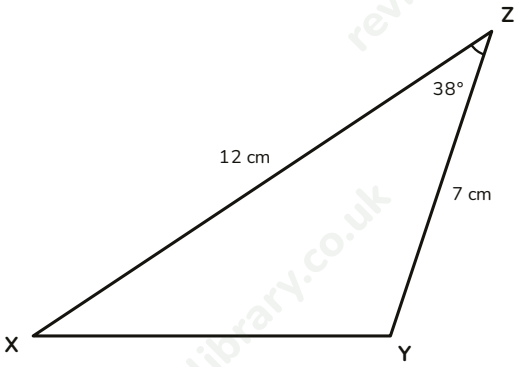
12 Triangle GHI has GH = 11 cm, HI = 9 cm and angle G = 46 degrees (angle at G between GH and GI). Calculate the third side GI to 2 decimal places using the cosine rule.



(Total for Question 12 is 3 marks)

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13 In triangle XYZ, side x = YZ = 7 cm, side y = ZX = 12 cm and angle Z = 38 degrees. Use the sine rule to find angle X in degrees, to the nearest degree. Show any ambiguous case consideration and give the correct final angle(s).



(Total for Question 13 is 3 marks)

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14 A triangular sail has sides 5.2 m and 7.4 m with included angle 112 degrees. A designer needs the area to the nearest 0.1 m², and also the length of the third side to 2 decimal places. First work out the area using 1/2 ab sin C, then find the third side using the cosine rule.

(Total for Question 14 is 4 marks)

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Mark scheme · 3.2 The Sine Rule, Cosine Rule and Area of a Triangle: Test Pack

Question 1

substitutes into sine rule: sin B / 15 = sin 50 / 12 and evaluates sin B = 15*sin50/12 **M1**

gives both possible angles B = 73 degrees and B = 107 degrees, correct to nearest degree, with statement that two values are possible **A1**

Answer: B = 73 degrees or 107 degrees (to nearest degree), two possible values

Question 2

correct statement that b cannot be determined uniquely from only a and A and that an ambiguous case may arise **B1**

Answer: Not unique: the sine rule does not give b from only a and A; an ambiguous case can arise and additional information is needed

Question 3

substitutes into area formula: Area = 1/2 * 13 * 14 * sin 58 **M1**

evaluates sine and multiplies correctly to a suitable intermediate accuracy **M1**

gives final area = 77.2 cm² correct to 1 decimal place, cao **A1**

Answer: 77.2 cm^2

Question 4

uses cosine rule: cos N = (MN^2 + NO^2 - MO^2) / (2*MN*NO) with correct substitution **M1**

evaluates cos N and finds N = 92 degrees (nearest degree), concluding angle N is obtuse **A1**

Answer: Angle N = 92 degrees (to nearest degree), so it is obtuse

Question 5

cosine rule: cos F = (8.4^2 + 8.2^2 - 9.7^2) / (2 x 8.4 x 8.2) **M1**

angle F = 71.50 degrees (more decimal places retained) **A1**

area = (1/2) x 8.4 x 8.2 x sin F **M1**

area = 32.7 cm² **A1**

Answer: 32.7 cm^2

Question 6

20.6 = (1/2) x 10.8 x x x sin 65 **M1**

x = 2 x 20.6 / (10.8 x sin 65) **M1**

x = 4.2 **A1**

Answer: x = 4.2

Question 7

angle R = 180 - 42 - 71 = 67 degrees **M1**

sine rule: PR = 13.2 x sin 71 / sin 42 **M1**

PR = 18.652 cm (retained) **A1**

area = (1/2) x 13.2 x 18.652 x sin 67 **M1**

area = 113.3 cm² **A1**

Answer: 113.3 cm^2

Question 8

angle B = 180 - 71 - 66 = 43 degrees **M1**

sine rule: AC = 9.1 x sin 43 / sin 71 **M1**

AC = 6.6 cm **A1**

Answer: AC = 6.6 cm

Question 9

angle AHB = 92 degrees **M1**

cosine rule to find AB = 28.24 km **M1**

sine rule to find angle HAB = 51.8 degrees (acute or obtuse chosen from the diagram) **M1**

uses the north line at A: bearing of H from A is the reverse of the bearing of A from H, then adds or subtracts the angle HAB **M1**

bearing = 348 degrees **A1**

Answer: 348 degrees

Question 10

sine rule: sin M / 7.1 = sin 36 / 13.3 **M1**

sin M = 7.1 x sin 36 / 13.3 = 0.3138 **M1**

angle M = 18.3 degrees **A1**

Answer: Angle M = 18.3 degrees

Question 11

angle M = 180 - 78 - 40 = 62 degrees **M1**

sine rule: LN = 6.8 x sin 62 / sin 78 **M1**

LN = 6.1 cm **A1**

Answer: LN = 6.1 cm

Question 12

applies cosine rule to form equation: HI^2 = GH^2 + GI^2 - 2*GH*GI*cos G and rearranges to a quadratic in GI **M1**

solves the quadratic correctly for GI (algebraic or using quadratic formula) **M1**

gives GI = 11.93 cm and GI = 3.35 cm to 2 decimal places, or notes the appropriate physically valid value(s) with correct rounding **A1**

Answer: GI = 11.93 cm or GI = 3.35 cm (to 2 dp)

Question 13

recognises this is an SAS configuration (angle Z is included between sides x = YZ = 7 and y = ZX = 12), so the cosine rule must be used first to find the third side z = XY: z^2 = x^2 + y^2 - 2xy cos Z = 7^2 + 12^2 - 2*7*12*cos38 **M1**

evaluates z = XY = 7.79 cm (to 2 dp), then applies the sine rule sin X / x = sin Z / z to get sin X = 7*sin38/7.79 **M1**

gives X = 34 degrees (to nearest degree), cao **A1**

Answer: X = 34 degrees (to nearest degree)

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Question 14

uses area formula: 1/2 * 5.2 * 7.4 * sin112 with correct substitution	**M1**
evaluates area to required accuracy	**M1**
uses cosine rule to form third side^2 = 5.2^2 + 7.4^2 - 2*5.2*7.4*cos112	**M1**
gives third side = 10.52 m (to 2 dp) and area = 17.8 m² (to 1 dp), cao	**A1**

Answer: Area = 17.8 m^2, third side = 10.52 m

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