**Topic 9**

**Trigonometric Ratios**

# Bronze, Silver, Gold

# Worksheets for

# AS Level Mathematics

# Teacher Notes

These Bronze, Silver and Gold worksheets are designed to be used either straight after the content has been taught or as part of a skills gap analysis, especially as students move into year 13.

They are drawn from the latest specification questions and legacy questions. The papers are between 25 and 35 marks.

The topic number on this worksheet relates to the corresponding chapter number in the ‘Pearson Edexcel AS and A Level Mathematics: Pure Mathematics Year 1/AS’ textbook.

# Non-Calculator Questions

The new specification allows calculators to be used in all papers. **We have, however, put these questions together with the intention that students can complete them without a calculator.** It’s important for pupils to be able to maintain their non-calculator skills, especially on topics such as surds or indices, to support question that use the keywords “show that” or “prove”. If you wish to ease the difficulty slightly then you can, of course, allow students to attempt them with the support of a calculator.

# Quick Links

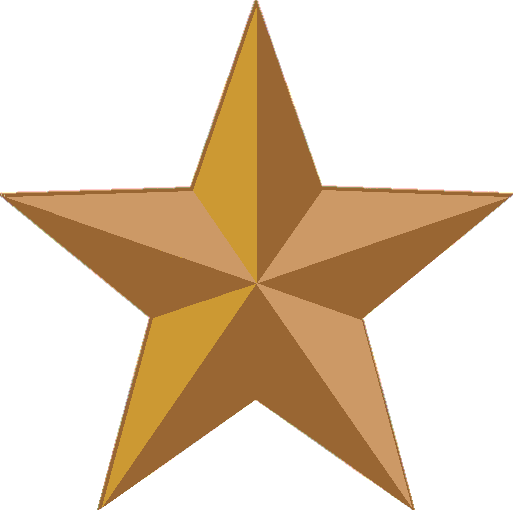
(Press Ctrl, as you click with your mouse to follow these links)

* [Bronze Questions](#BrQue)
* [Bronze Mark Scheme](#BrMS)
* [Silver Questions](#SiQue)
* [Silver Mark Scheme](#SiMS)
* [Gold Questions](#GoQu)
* [Gold Mark Scheme](#GoMS)

# Extension and Enrichment

If you have students that have enjoyed the challenge of the Gold questions, then they should have a go at the more challenging question from our Advanced Extension Award (AEA) papers. The Mathematics AEA is a single, 3 hour non-calculator paper, taken at the end of year 13. It helps students to develop high level problem solving and proof skills. It is entirely based on the content of the A Level Mathematics Course. No extra material needs to be covered to take the AEA in Mathematics. A second important difference is that marks are awarded for the clarity and quality of their solution. Developing this key skill, alongside the extra problem-solving experience, can pay dividends in the way they approach A Level Mathematics and Further Mathematics problems.

More information about the Advanced Extension Award can be found [here](https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/advanced-extension-award-mathematics-2018.html) on the Pearson Edexcel Website, or [here](https://www.mathsemporium.com/category/advanced-extension-award-mathematics/) on the Maths Emporium

**Bronze Questions **

**Calculators may not be used**

The total mark for this section is 25

**Q1**

Find the exact value of tan 30° × sin 60°

Give your answer in its simplest form.

**(Total for Question 1 is 2 marks)**

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**Q2**

(a)Write down the exact value of tan 45°

**(1)**

Here is a right-angled triangle.



 cos 60° = 0.5

(b)Work out the value of *x*.

**(2)**

**(Total for Question 2 is 3 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q3**

In the triangle *ABC*, *AB* = 1m, *AC* =m, angle *ABC* = 60° and angle *BCA*= *x*°

Find the two possible values for *x*.

**(Total for Question 3 is 4 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q4**

Here is the graph of *y* = sin *x*° for –180 ⩽ *x* ⩽ 180

**

On the grid, sketch the graph of *y* = sin *x*° – 2 for –180 ⩽ *x* ⩽ 180

**(Total for Question 4 is 2 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q5**

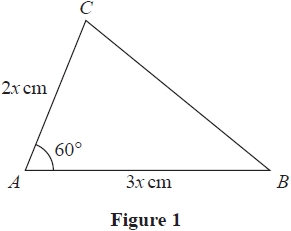


Figure 1 shows a sketch of a triangle *ABC* with *AB* = 3*x* cm, *AC* = 2*x* cm and   
angle *CAB* = 60°

Given that the area of triangle *ABC* is cm2

(a)  Show that *x* = 

**(3)**

(b)  Hence find the exact length of *BC*, giving your answer as a simplified surd.

**(3)**

**(Total for Question 5 is 6 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q6**

In triangle *RPQ*,

*RP* = cm   
*PQ* = 1 cm   
Angle *PRQ* = 30°

(a)  Assuming that angle *PQR* is an acute angle,   
calculate the area of triangle *RPQ*.   
Give your answer in exact form.

**(4)**

(b)  If you did not know that angle *PQR* is an acute angle, what effect would this have on your calculation of the area of triangle *RPQ*?

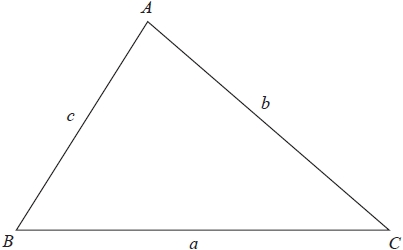
**(1)**

**(Total for Question 6 is 5 marks)**

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**Q7**

The diagram shows an acute-angled triangle *ABC*.

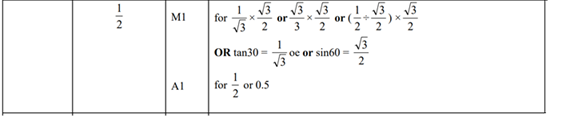


Prove that area of triangle 

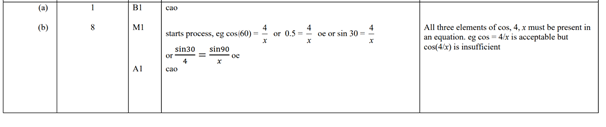
**(Total for Question 7 is 3 marks)**

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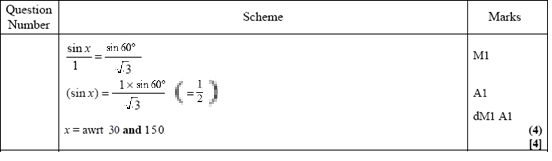
**Bronze Mark Scheme**

 **Q1.**

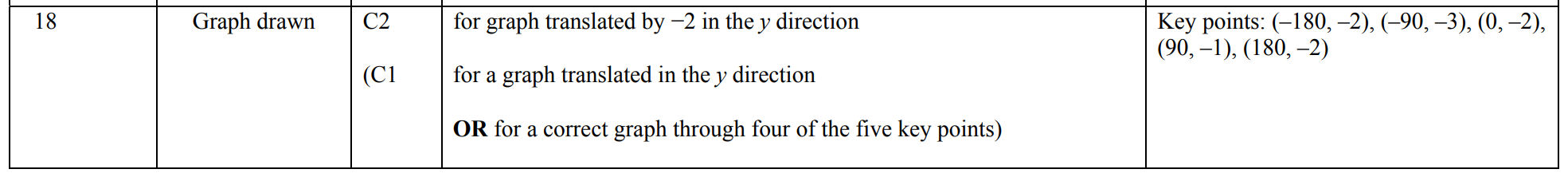
**Q2.**

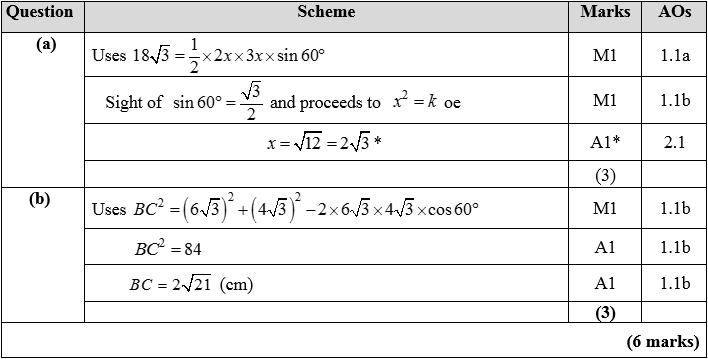
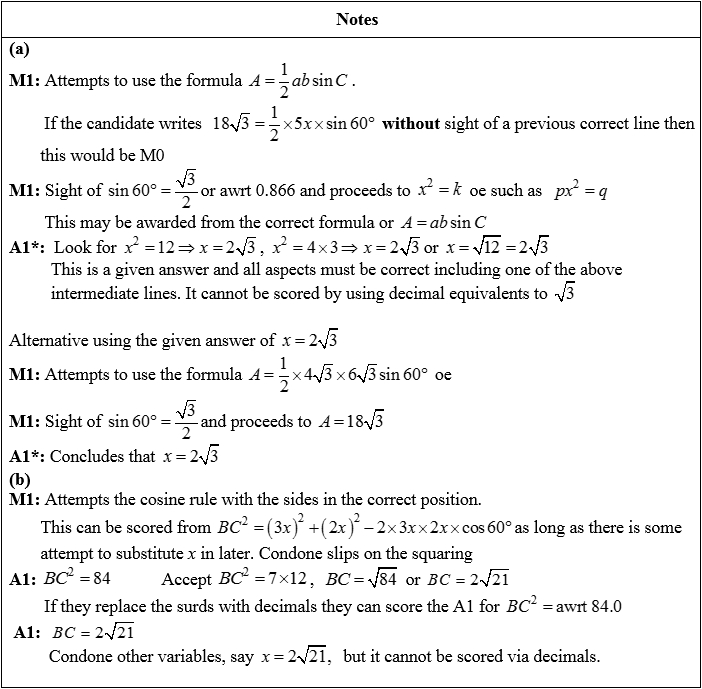
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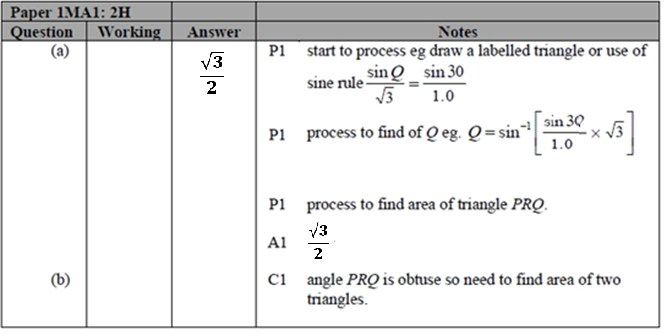
**Q3.**

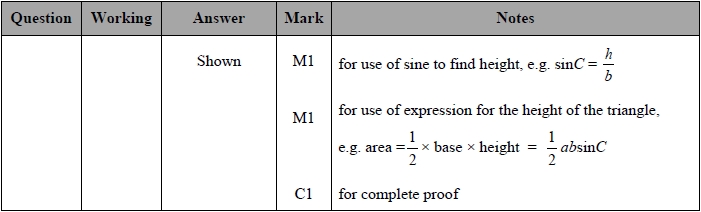


**Q4.**



**Q5.** 

**Q6.**

**Q7.**

**Silver Questions **

**Calculators may not be used**

The total mark for this section is 29

**Q1**

In the triangle *ABC*, *AB* = 5 cm, *AC* = 4 cm, angle *ABC* = 45° and angle *BCA*= *x*°

Find the two possible values for *x*, giving your answers in exact form.

**(Total for Question 1 is 4 marks)**

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**Q2**

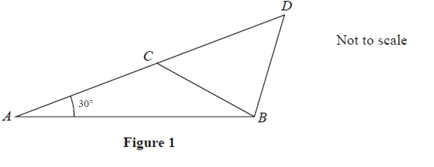


Figure 1 shows the design for a structure used to support a roof.

The structure consists of four steel beams, *AB*, *BD*, *BC* and *AD*.

Given *AB* = m, *BC* = *BD* = 1m and angle *BAC* = 30°

Find, the size of angle *ACB*.

**(Total for Question 2 is 3 marks)**

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**Q3**

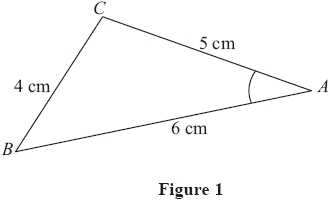


Figure 1 shows the triangle *ABC*, with *AB* = 6 cm, *BC* = 4 cm and *CA* = 5 cm.

(a)  Show that .

**(3)**

(b)  Hence, or otherwise, find the exact value of sin *A*.

**(2)**

**(Total for Question 3 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q4**

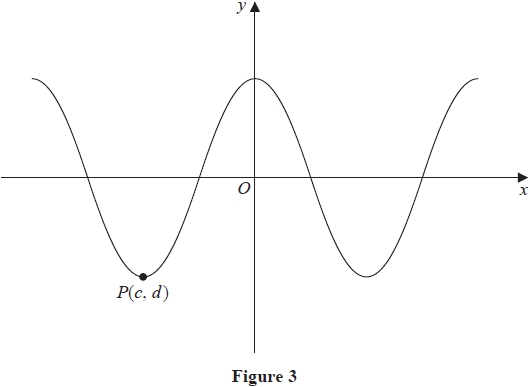


Figure 3 shows part of the curve with equation *y* = 3 cos *x*°.

The point *P*(*c*, *d*) is a minimum point on the curve with *c* being the smallest negative value of *x* at which   
a minimum occurs.

(a)  State the value of *c* and the value of *d*.

**(1)**

(b)  State the coordinates of the point to which *P* is mapped by the transformation which

transforms the curve with equation *y* = 3 cos *x*° to the curve with equation

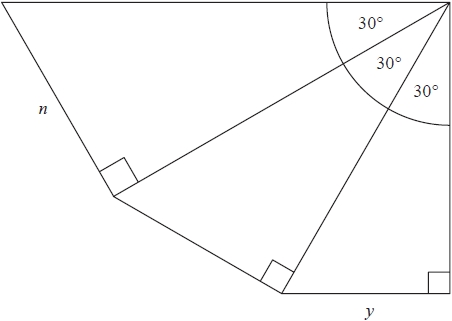
(i)  

(ii)  *y* = 3 cos (*x* – 36)°

**(2)**

**(Total for Question 4 is 3 marks)**

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**Q5**

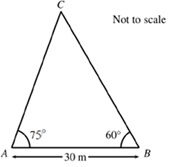
The diagram shows three right-angled triangles.

Prove that 

**(Total for Question 5 is 4 marks)**

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**Q6**



**Figure 1**

A triangular lawn is modelled by the triangle *ABC*, shown in Figure 1. The length *AB* is to be 30 m long.

Given that angle *BAC* = 75° and angle *ABC* = 60°,

(a) Calculate the length AC **(2)**

Given that BC=15+15

(b)  Calculate the area of the lawn in exact form.

**(2)**

(c)   Why is your answer unlikely to be accurate to the nearest square metre?

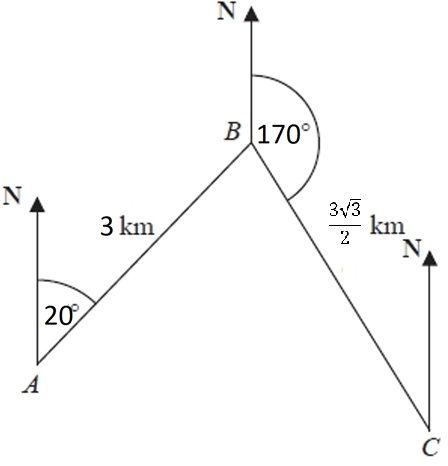
**(1)**

**(Total for Question 6 is 5 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q7**

The diagram shows the positions of three towns, Acton (*A*), Barston (*B*) and Chorlton (*C*).



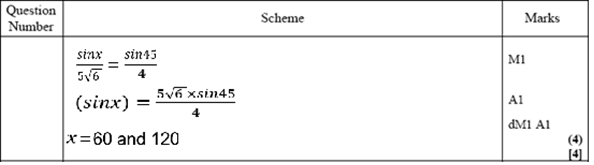
Barston is 3 km from Acton on a bearing of 020°   
Chorlton is km from Barston on a bearing of 170°

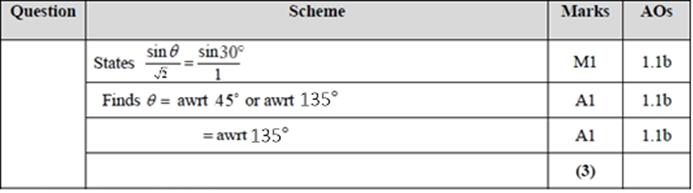
Find the bearing of Chorlton from Acton.   
You must show all your working.

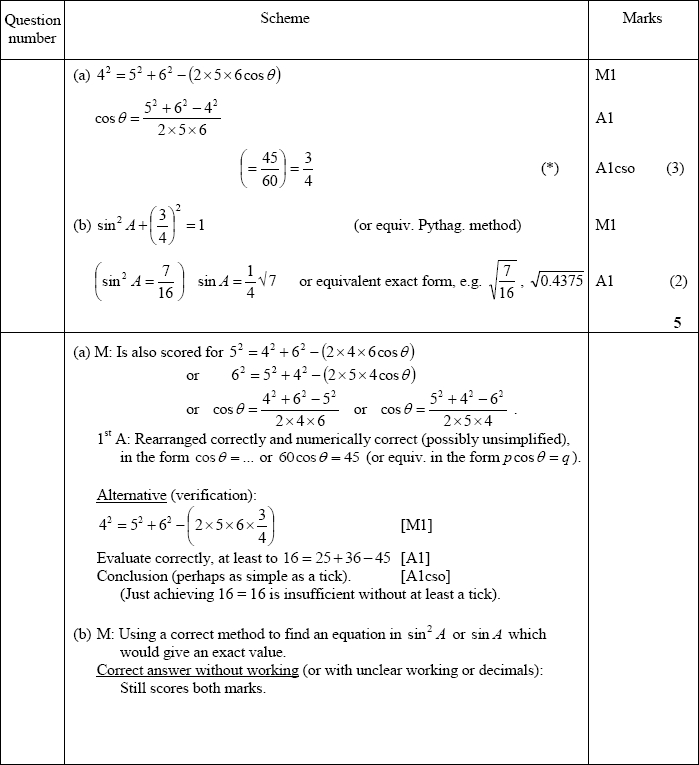
**(Total for Question 7 is 5 marks)**

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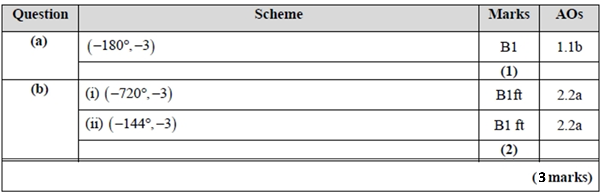
**Silver Mark Scheme**

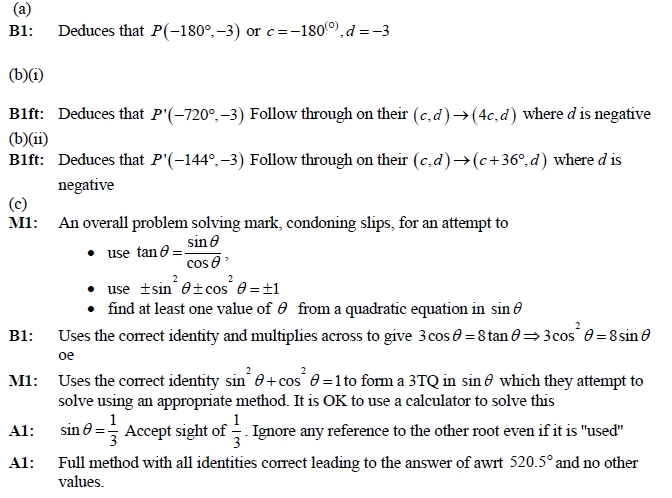
**Q1.**

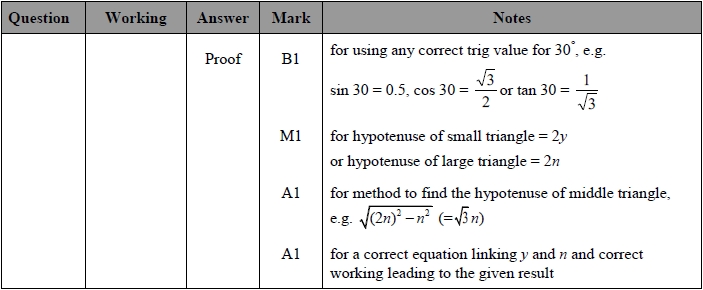
**Q2.**

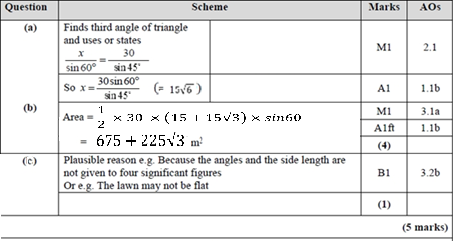
**Q3.**

**Q4.**





**Q5.**

**Q6.**

**Q7.**

**Table

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**Gold Questions **

**Calculators may not be used**

The total mark for this section is 29

**Q1**

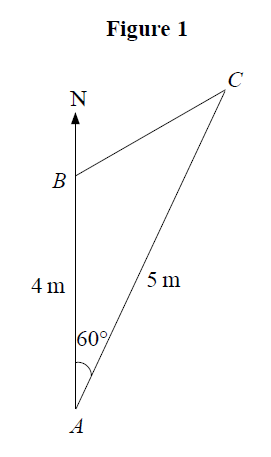


Figure 1 shows 3 yachts *A*, *B* and *C* which are assumed to be in the same horizontal plane. Yacht *B* is 4 m due north of yacht *A* and yacht *C* is 5 m from A. The bearing of *C* from *A* is 060°.

Calculate the distance between yacht *B* and yacht *C*, in exact form.

**(Total for Question 1 is 3 marks)**

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**Q2**

In a triangle *ABC*, side *AB* has length 10 cm, side *AC* has length 5 cm, and angle *BAC* = *θ* where *θ* is measured in degrees. The area of triangle *ABC* is 15cm2

(a)  Find the two possible values of cos *θ*

**(4)**

Given that *BC* is the longest side of the triangle,

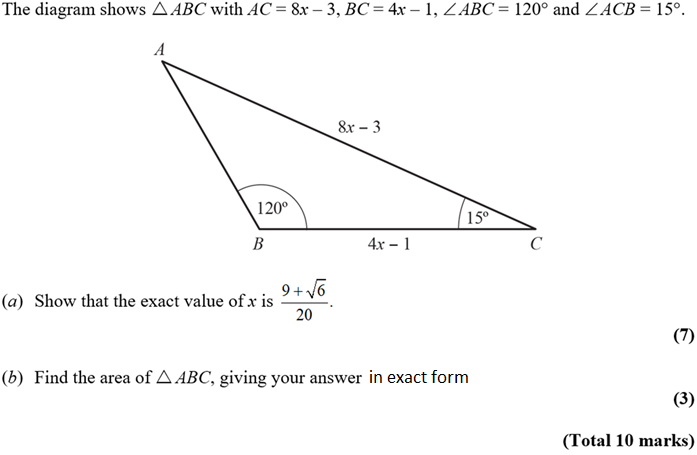
(b)  find the exact length of *BC*.

**(2)**

**(Total for Question 2 is 6 marks)**

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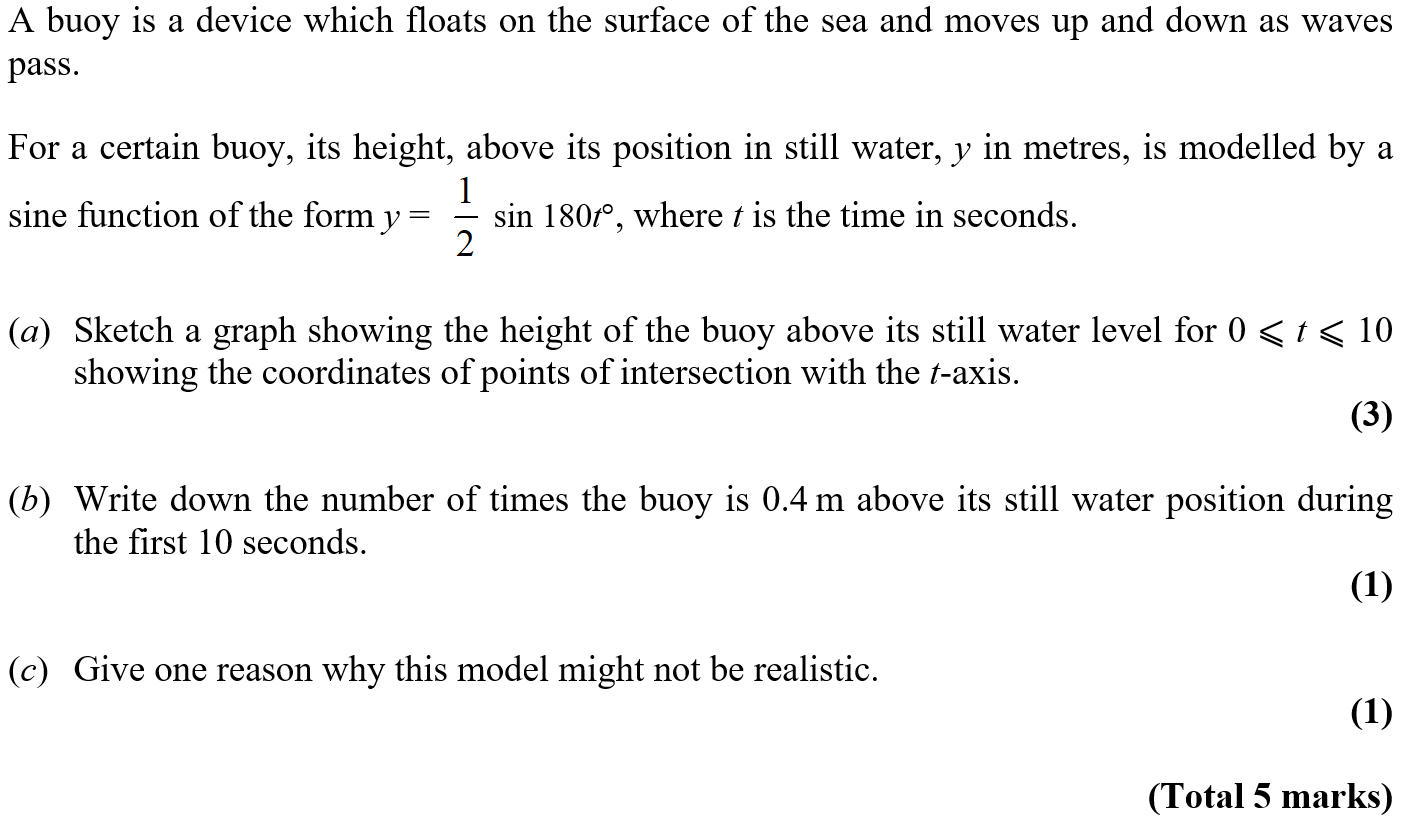
**Q3**



**(Total for Question 3 is 10 marks)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q4**



**(Total for Question 4 is 5 marks)**

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**Q5** The diagram shows a hexagon *ABCDEF*.

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*ABEF* and *CBED* are congruent parallelograms where *AB* = *BC* = *x* cm.

*P* is the point on *AF* and *Q* is the point on *CD* such that *BP = BQ =* 10 cm.

Given that angle *ABC* = 30°,

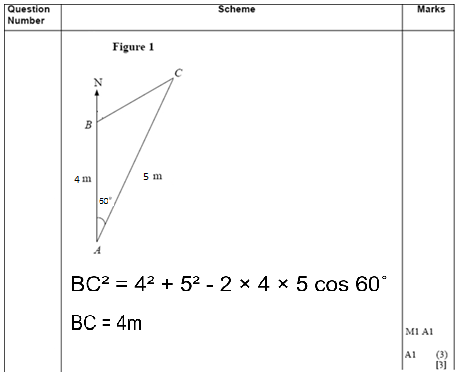
prove that cos *PBQ* = 1 –  *x*2

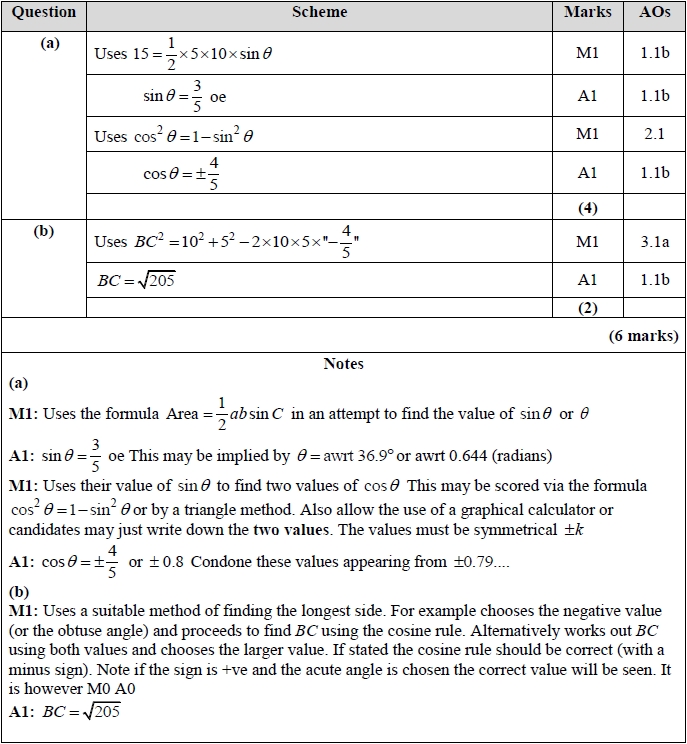
**(Total for Question 5 is 5 marks)**

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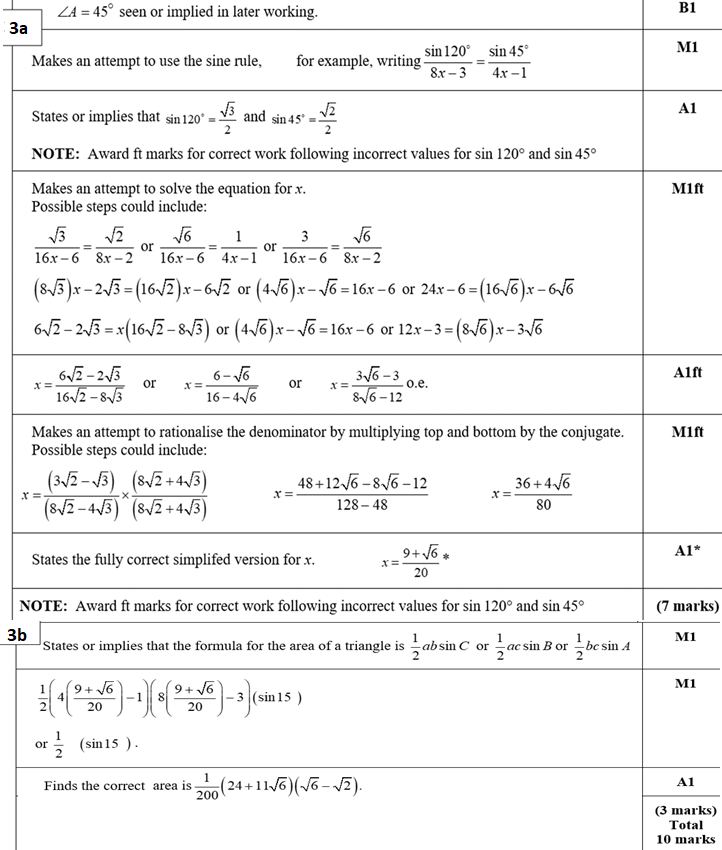
**Gold Mark Scheme**

**Q1.**

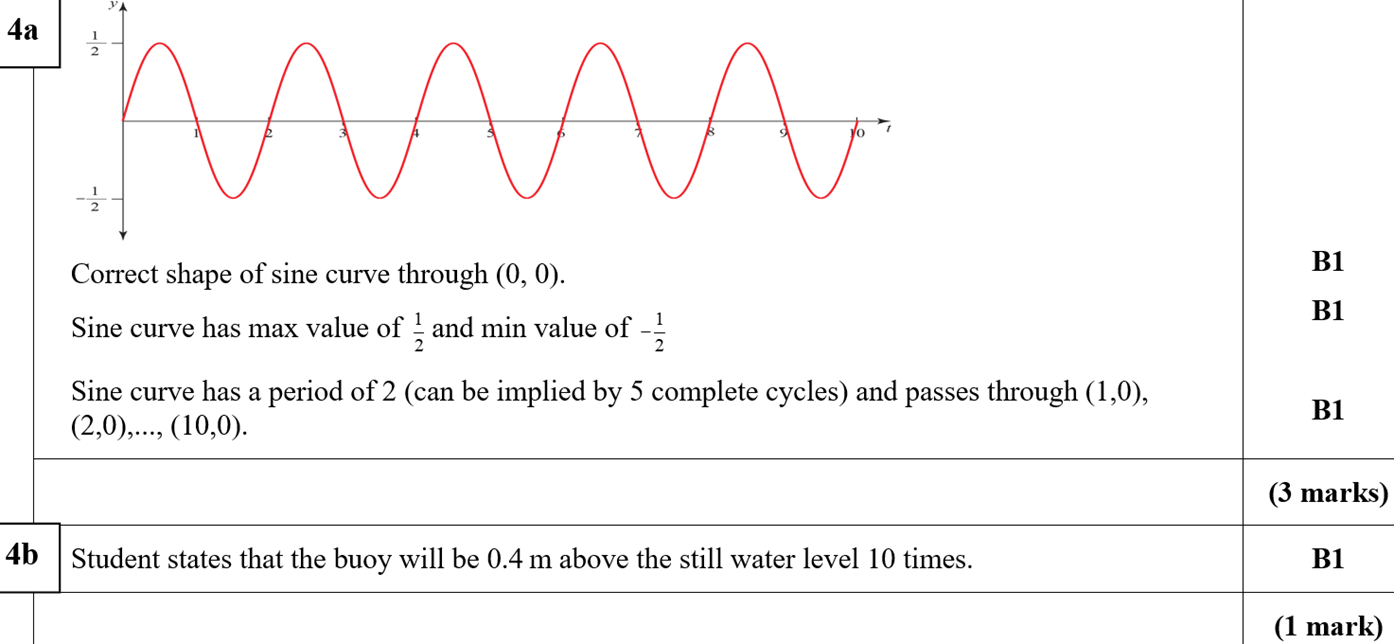


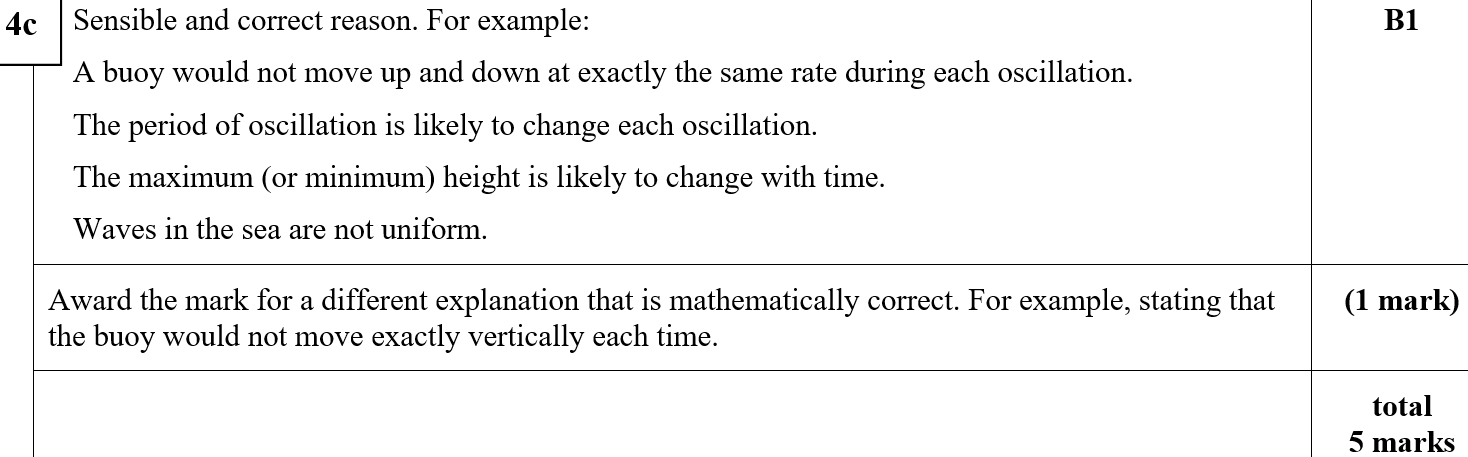
**Q2.**

**Q3.**

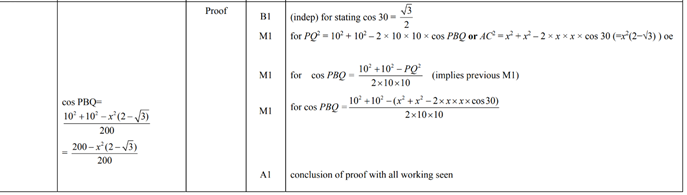
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**Q4.**



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**Q5.**

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