

Name: \_\_\_\_\_

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# Higher Unit 5b topic test

Date:

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**Time:** 50 minutes

**Total marks available:** 50

**Total marks achieved:** \_\_\_\_\_

## Questions

Q1.

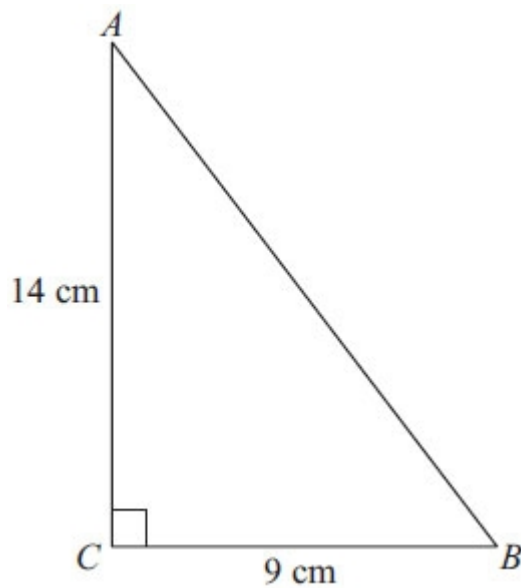


Diagram **NOT**  
accurately drawn

Calculate the length of  $AB$ .  
Give your answer correct to 1 decimal place.

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(Total for Question is 3 marks)

**Q2.**

$ABCD$  is a trapezium.

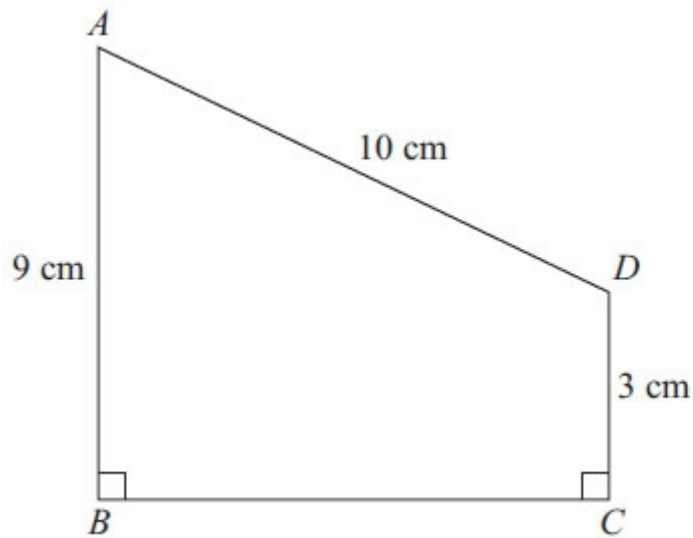


Diagram **NOT**  
accurately drawn

$$AD = 10 \text{ cm}$$

$$AB = 9 \text{ cm}$$

$$DC = 3 \text{ cm}$$

$$\text{Angle } ABC = \text{angle } BCD = 90^\circ$$

Calculate the length of  $AC$ .

Give your answer correct to 3 significant figures.

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

Q3.

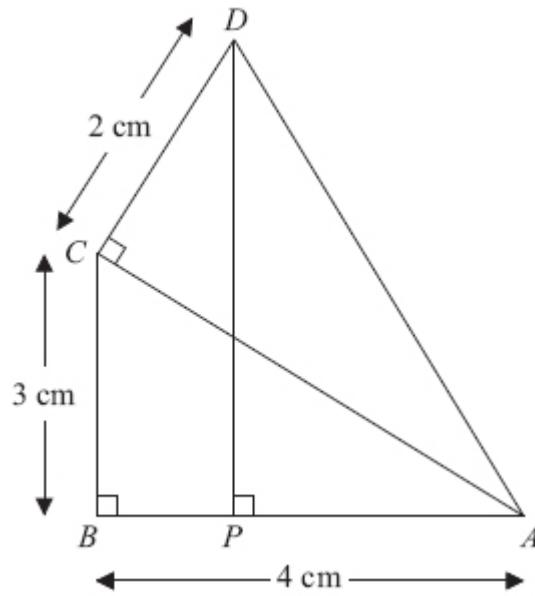


Diagram **NOT**  
accurately drawn

In the diagram,

$ABC$ ,  $ACD$  and  $APD$  are right-angled triangles.

$AB = 4$  cm.

$BC = 3$  cm.

$CD = 2$  cm.

Work out the length of  $DP$ .

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(Total for Question is 5 marks)

**Q4.**

The diagram represents a metal frame.

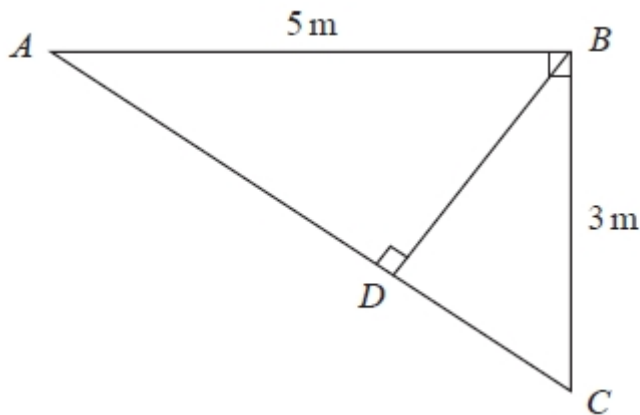


Diagram **NOT**  
accurately drawn

The frame is made from four metal bars,  $AB$ ,  $AC$ ,  $BC$  and  $BD$ .

Angle  $ABC = \text{angle } ADB = 90^\circ$

$AB = 5 \text{ m}$

$BC = 3 \text{ m}$

Work out the total length of the four metal bars of the frame.

Give your answer correct to 3 significant figures.

..... m

**(Total for question = 5 marks)**

**Q5.**

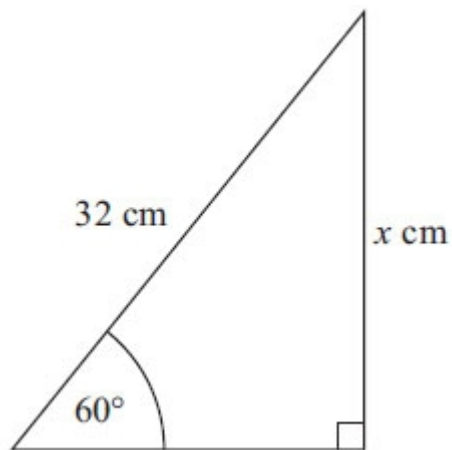


Diagram **NOT**  
accurately drawn

Calculate the value of  $x$ .  
Give your answer correct to 3 significant figures.

.....  
(Total for Question is 3 marks)

**Q6.**

Triangle  $ABC$  has a right angle at  $C$ .

Angle  $BAC = 48^\circ$ .

$AB = 9.3$  cm.

Calculate the length of  $BC$ .

(Total for question = 3 marks)

Q7.

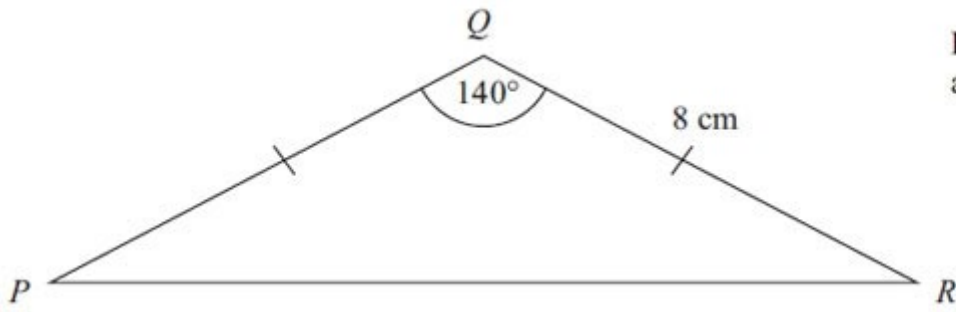


Diagram NOT  
accurately drawn

Calculate the length of  $PR$ .  
Give your answer correct to 3 significant figures.

..... cm  
(Total for Question is 3 marks)

Q8.

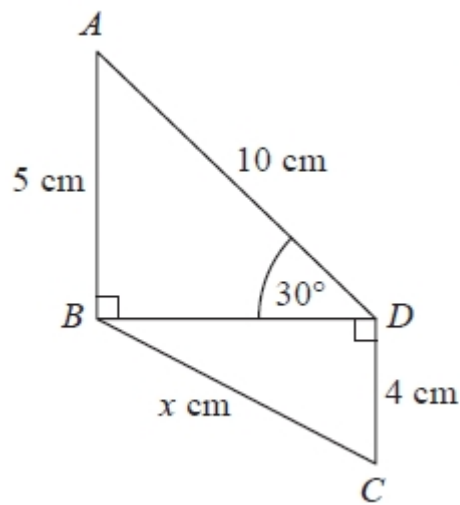


Diagram NOT accurately drawn

In the diagram,

triangles  $ABD$  and  $BCD$  are right-angled triangles

$AB = 5$  cm

$AD = 10$  cm

$CD = 4$  cm

Angle  $ADB = 30^\circ$

Work out the value of  $x$ .

Give your answer correct to 2 decimal places.

.....cm

(Total for question = 4 marks)



Q9.

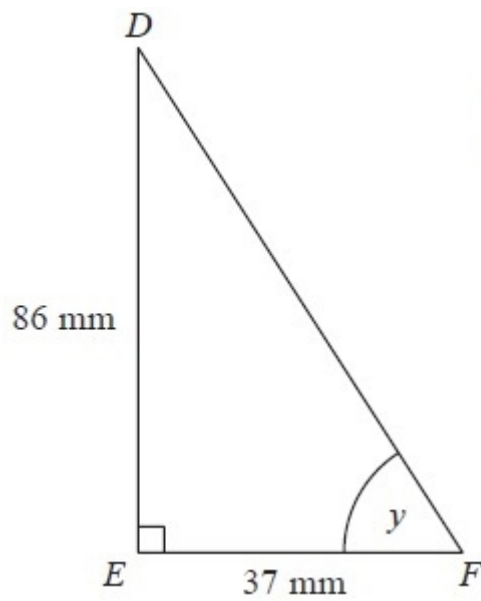


Diagram **NOT**  
accurately drawn

$DEF$  is a right-angled triangle.

$DE = 86 \text{ mm}$

$EF = 37 \text{ mm}$

Calculate the size of the angle marked  $y$ .

Give your answer correct to 1 decimal place.

.....°

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

**Q10.**

The diagram shows a ladder leaning against a vertical wall.

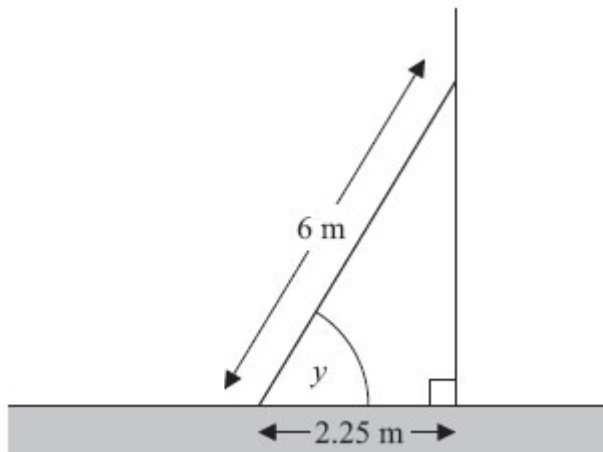


Diagram **NOT**  
accurately drawn

The ladder stands on horizontal ground.

The length of the ladder is 6 m.

The bottom of the ladder is 2.25 m from the bottom of the wall.

A ladder is safe to use when the angle marked  $y$  is about  $75^\circ$ .

Is the ladder safe to use?

You must show all your working.

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

Q11.

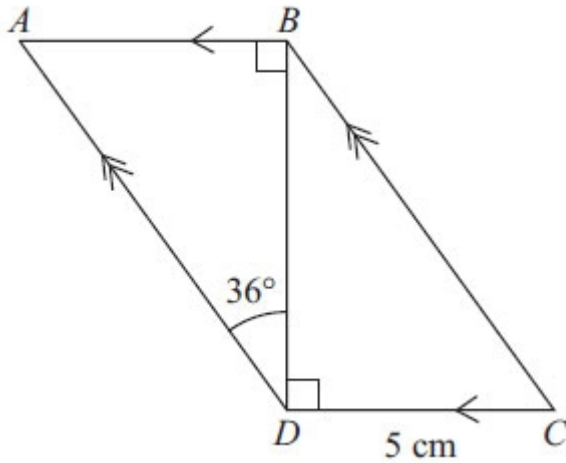


Diagram **NOT**  
accurately drawn

$ABCD$  is a parallelogram.

$DC = 5$  cm

Angle  $ADB = 36^\circ$

Calculate the length of  $AD$ .

Give your answer correct to 3 significant figures.

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(Total for Question is 4 marks)

**Q12.**

The diagram shows a quadrilateral  $ABCD$ .

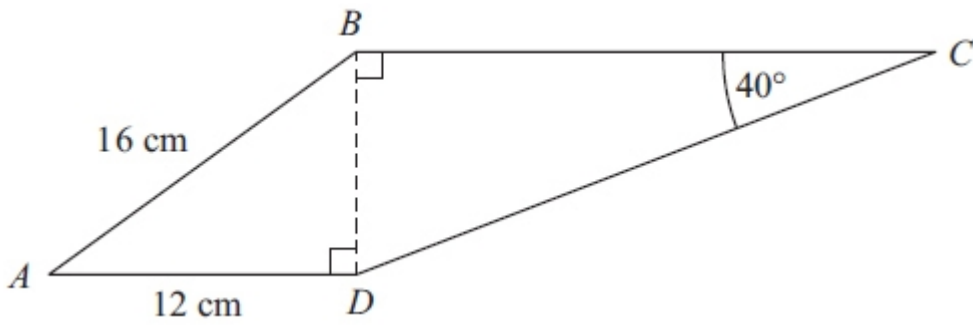


Diagram **NOT** accurately drawn

$AB = 16\text{ cm}$ .

$AD = 12\text{ cm}$ .

Angle  $BCD = 40^\circ$ .

Angle  $ADB = \text{angle } CBD = 90^\circ$ .

Calculate the length of  $CD$ .

Give your answer correct to 3 significant figures.

..... cm

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

**Q13.**

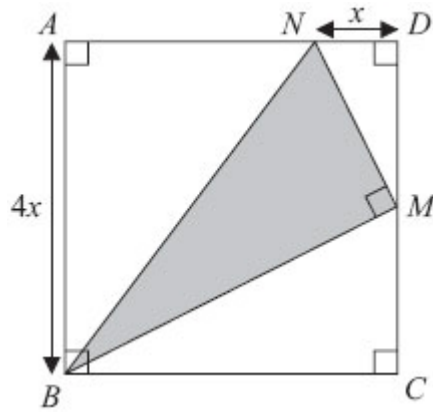


Diagram **NOT**  
accurately drawn

$ABCD$  is a square with a side length of  $4x$

$M$  is the midpoint of  $DC$ .

$N$  is the point on  $AD$  where  $ND = x$

$BMN$  is a right-angled triangle.

Find an expression, in terms of  $x$ , for the area of triangle  $BMN$ .

Give your expression in its simplest form.

.....  
(Total for Question is 4 marks)

## Examiner's Report

### Q1.

This standard Pythagoras question was well answered. A few candidates tried to use the cosine rule. They did not earn any marks until they had got to the equivalent stage to using the Theorem of Pythagoras.

### Q2.

A common incorrect answer was 10.4 cm which came from attempting to use Pythagoras's theorem in triangle  $ADC$  which clearly does not contain a right angle. Other incorrect assumptions were that  $BC$  was 9 cm and/or angle  $ACB$  was  $45^\circ$ . Those candidates who drew a line parallel to  $BC$  from  $D$  generally went onto gain either full marks or at least one mark as errors occurred while using Pythagoras's theorem. It was disappointing that relatively few candidates realised that the trapezium could be divided in such a way that the length of the base could be found using Pythagoras's theorem. Many candidates stated the length of the upper part of  $AB$  was 6 but then did not always use the information correctly. A significant minority of candidates calculated the area of the trapezium. A few candidates used trigonometry to find angle  $ADC$  and then used the cosine rule in triangle  $ACD$ .

### Q3.

This question was poorly done except by the most able candidates. The vast majority only managed to gain the first method mark for Pythagoras and generally  $AC = 5$ . Very few recognised the need to use trigonometry and many attempted to use the cosine formula badly. Of those who did use trigonometry, the sine rule was seen most commonly.

### Q4.

Again there were quite a number of nil attempts. However, most students identified that they needed to use Pythagoras as a first step, and  $AC$  was usually found correctly. It was rare to find students proceeding further in a logical way, since many incorrectly assumed that  $CBD$  or  $ABD$  was  $45^\circ$ . Any attempt at using trigonometry was usually based on an incorrect side or angle. No student used a similar triangle approach.

### Q5.

On the whole, candidates either scored full marks or no marks in this question. A few candidates were unable to recognise the correct trigonometric function even having written SOHCAHTOA, others were able to start with a correct trigonometric statement and then made errors when rearranging their initial statement but most who got this far went onto obtain full marks. It was evident that some candidates had their calculator in the wrong angle mode. It was surprising the number of candidates who confused lengths and angles in their calculations. Some candidates seemed to take a lucky guess that the adjacent side was half of 32 with no evidence of the use of  $\cos 60$  and were then able to use Pythagoras to find  $x$  correctly.

### Q6.

No Examiner's Report available for this question

**Q7.**

The most common correct method seen was the use of the cosine rule; other candidates used the sine rule successfully; others dropped a perpendicular line and used the two right-angled triangles. The majority of candidates who could see an appropriate method to use went on to gain full marks. Those who used the sine rule method often substituted the numbers correctly, but were unable to proceed further. The most common incorrect method was to attempt to use Pythagoras' Theorem.

**Q8.**

This question was not always attempted. When it was attempted, a common error was for students to calculate  $10^2 + 5^2$  rather than  $10^2 - 5^2$  in their application of Pythagoras' Theorem. Premature rounding led some students to lose accuracy in their answers and consequently score 3 out of the 4 marks available.

**Q9.**

The correct answer was often seen but not always the result of the most straightforward method. Many candidates found the length  $DF$  by Pythagoras and then used sine or cosine. Some even attempted to use the sine rule. However, many choosing these alternative approaches made careless mistakes in their algebraic manipulation and failed to score as a result.

A significant number started well with " $\tan = \frac{86}{37}$ " but could go no further.

**Q10.**

Many correctly identified Cosine as the method of solution, found the angle and wrote an appropriate statement to go with it. Some candidates however tried Pythagoras with either the Sine or Cosine Rule with varying degrees of success.

**Q11.**

Most candidates scored either 1 mark (for  $AB = 5$  cm), or full marks for finding the length of  $AD$  correctly. It was very common to see the sine rule being used in the right angled triangle  $ABD$ , sometimes involving the right angle and sometimes the  $54^\circ$ . A few candidates used tan and Pythagoras in triangle  $ABD$ . Providing all the steps involved were logically correct, they were awarded the two method marks. Often this approach led to an answer outside the acceptable range, due to accumulation of rounding errors.

### Q12.

This question required the candidates to first find the side  $BD$  and then to use that to find the length of the side  $CD$ . Many got off to a good start by correctly using Pythagoras to find  $BD$ . At that point a number of candidates stopped, possibly believing that they had answered the question, and so lost the remaining three marks. Of those that realised they needed to continue, a good many managed to use a correct trigonometric expression to gain the third mark, although incorrect rearrangement often meant that they gained no further marks. Those that chose to use 'tan' often missed out on the remaining method mark for not realising that they had worked out the side  $BC$  and so still needed to do one further calculation. Candidates who used Pythagoras incorrectly in the first stage were still able to gain the two marks for the second stage if they used their value for the length  $BD$  correctly. Early rounding of the length  $BD$  to 10.6 in this question was not penalised as it still gave an answer within the range. Candidates should, however, be reminded not to prematurely round answers to 1dp at the intermediate stages of calculations.

### Q13.

The best candidates gave clear and concise solutions to this question. However most candidates were unable to make much headway in giving accurate expressions for the area of the square or for the area of the unshaded triangles or for the sides of the shaded triangle. A large proportion of the algebra seen was spoiled by the omission of brackets, for example by expressing the area of the square as  $4x \times x$  or as  $4x^2$  instead of  $4x \times 4x$ ,  $(4x)^2$ , or  $16x^2$  or in attempts to use Pythagoras rule. The square root sign was often used wrongly or ambiguously. These errors led to many candidates failing to score any credit for their attempts. Most candidates used the method of finding the area of the square and subtracting the areas of the three unshaded triangles but there were some excellent solutions harnessing Pythagoras rule to find the lengths of the sides  $NM$  and  $BM$  and then the area of triangle  $BNM$ . A significant proportion of candidates did not attempt this question.



## Mark Scheme

Q1.

Question	Working	Answer	Mark	Notes
	$9^2 + 14^2 = 81 + 196 = 277$ $AB = \sqrt{277}$	16.6	3	M1 $9^2 + 14^2$ or $81 + 196$ or $277$ M1 $\sqrt{277}$ or $\sqrt{81+196}$ or A1 16.6 -16.643

Q2.

Question	Working	Answer	Mark	Notes
	$9 - 3 = 6$ $10^2 - 6^2 = 64$ $BC = 8$ $AC^2 = 9^2 + 8^2 = 145$	12.0	5	M2 $10^2 - (9 - 3)^2 (=64)$ or $BC = 8$ (M1 $9 - 3 (= 6)$ may be seen on diagram) M1 (indep) $9^2 + 'BC'^2$ where $BC$ is a numerical value M1 (dep on previous M1) $\sqrt{81 + '64'}$ A1 12.0 – 12.042

Q3.

Working	Answer	Mark	Notes
	4.6	5	M1 for $AC = \sqrt{(32+42)} (=5)$ or $DA = \sqrt{(52+22)}$ M1 for $\tan BAC = 0.75$ oe or $(BAC=)$ 36.8(6) or 36.9 M1 for $\tan DAC = 0.4$ oe or $(DAC=)$ 21.8(0) M1 for $\sqrt{5^2 + 2^2} \times$ $\sin("36.8(6)" + "21.8(0)")$ or $5.385 \times \sin 58.7$ A1 for 4.59 – 4.61  OR M1 for $AC = \sqrt{3^2 + 4^2} (= 5)$ or $DP = \sqrt{(29 - AP^2)}$ M1 for $\cos BAC = 0.8$ oe or $(BAC=)$ 36.8(6) oe M1 for angle $CDP =$ angle $BAC$ M1 for $(DP=)$ $3 + 2 \times \cos CDP$ or $(AP=)$ $4 - 2 \times \sin CDP$ A1 for 4.59 – 4.61

Q4.

PAPER: IMA0_2H				
Question	Working	Answer	Mark	Notes
	$AC^2 = 5^2 + 3^2$ $AC = \sqrt{25 + 9} (=5.83)$ $\frac{5}{5.83} = \frac{DB}{3}$ $DB = \frac{5}{5.83} \times 3 (=2.57)$ $5 + 3 + 5.83 + 2.57 =$ <b>OR</b> $AC = \sqrt{25 + 9} (=5.83)$ $\tan A = \frac{3}{5}$ $A = 30.96$ $\sin 30.96 = \frac{DB}{5}$ $DB = 5 \times \sin 30.96 (=2.57)$ $5 + 3 + 5.83 + 2.57 =$	16.4	5	M1 for $(AC^2) = 5^2 + 3^2 (=34)$ M1 for $\sqrt{25 + 9}$ or $\sqrt{34} (=5.83)$ M1 for $\frac{5}{5.83} = \frac{DB}{3}$ or $DB \times AC = 5 \times 3$ M1 for $(DB =) \frac{5}{5.83} \times 3$ A1 for 16.4 to 16.41 <b>OR</b> M1 for $(AC^2) = 5^2 + 3^2 (=34)$ M1 for $\sqrt{25 + 9}$ or $\sqrt{34} (=5.83)$ M1 for using a correct trig ratio in an attempt to find angle $A$ or angle $C$ , e.g. $\tan A = \frac{3}{5}$ , $\sin A = \frac{3}{5.83}$ , $\cos C = \frac{3}{5.83}$ M1 for using $DB$ in a correct trig ratio, e.g. $\sin 30.96 = \frac{DB}{5}$ A1 for 16.4 to 16.41

Q5.

Question	Working	Answer	Mark	Notes
	$\sin 60^\circ = \frac{x}{32}$ $x =$ $32 \times \sin$ $60 (=27.712\dots)$	27.7	3	M1 $\sin 60 = \frac{x}{32}$ <b>or</b> $\frac{x}{\sin 60} = \frac{32}{\sin 90}$ <b>or</b> M1 $(x = ) 32 \times \sin 60$ <b>or</b> $(x = ) \frac{32}{\sin 90} \times \sin 60$ A1 27.7 - 27.72 <b>OR</b> M1 $\cos(90 - 60) = \frac{x}{32}$ M1 $(x = ) 32 \times \cos(90 - 60)$ A1 27.7 - 27.72 Radians : - 9.7539398... Gradians : 25.888554... SC : B2 for an answer in the range (-) 9.75 to (-)9.754 <b>or</b> 25.8 to 25.9

Q6.

Question	Working	Answer	Mark	AO	Notes
	$9.3 \times \sin 48^\circ$	6.911 cm	P	2.3a	P1 for process to decide which trig function to use from description
			M	1.3a	M1 $9.3 \times \sin 48^\circ$
			A	1.3a	A1 awrt 6.91cm

Q7.

	Working	Answer	Mark	Notes
		15.0	3	<p>M1 for <math>8^2 + 8^2 - 2 \times 8 \times 8 \times \cos 140</math>  M1 (dep) for correct order of evaluation  <b>or</b> 226.(05...)  A1 for answer in range 15.0 – 15.04</p> <p><b>OR</b></p> <p>M1 for <math>\frac{PR}{\sin 140} = \frac{8}{\sin\left(\frac{180-140}{2}\right)}</math>  M1 for <math>PR = \frac{8}{\sin\left(\frac{180-140}{2}\right)} \times \sin 140</math>  A1 for answer in range 15.0 – 15.04</p> <p><b>OR</b></p> <p>M1 for <math>8 \times \sin 70</math> or <math>8 \times \cos 20</math>  M1 for <math>2 \times 8 \times \sin 70</math> <b>or</b> <math>2 \times 8 \times \cos 20</math>  A1 for answer in range 15.0 – 15.04</p>

Q8.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		9.54	4	<p>M1 for <math>10^2 - 5^2 (= 75)</math> or <math>(BD =)</math>  <math>10 \times \cos 30 (= 8.66...)</math>  M1 for <math>"75" + 4^2 (= 91)</math> or  <math>"8.66..."^2 + 4^2 (= 91)</math>  M1 for <math>\sqrt{(10^2 - 5^2 + 4^2)}</math> or  <math>\sqrt{("8.66..."^2 + 4^2)}</math>  A1 for 9.53 – 9.54</p>

Q9.

PAPER: 5MB3H 01				
Question	Working	Answer	Mark	Notes
		66.7	3	M1 for $\tan (y) = \frac{86}{37} (= 2.3243..)$ M1 (dep) for $\tan^{-1} "2.32(43..)" = \text{or } \tan^{-1} \left(\frac{86}{37}\right)$ (accept 'shift tan' or 'inv tan' for $\tan^{-1}$ ) A1 for answer in the range $66.6^\circ$ to $66.8^\circ$  [SC: B1 for an answer in the range 23.2 to 23.3 if M0 scored]

Q10.

	Working	Answer	Mark	Notes
	$\cos y = 2.25 \div 6$ $y = \cos^{-1} (2.25 \div 6)$  OR $6\cos 75 = 1.55...$	The ladder is not safe because $y$ is not near to $75$	3	M1 for $\cos y = 2.25 \div 6$ oe M1 for $\cos^{-1} (2.25 \div 6)$ C1 for sight of 67-68 and a statement eg this angle is NOT (near to) $75^\circ$ and so the ladder is not steep enough and so not safe.  OR M1 for $\cos 75 = x \div 6$ M1 for $6\cos 75$ C1 for sight of 1.55(29...) and a statement eg that 2.25 NOT (near to) 1.55 and so the ladder is not steep enough and so not safe.

Q11.

Question	Working	Answer	Mark	Notes
	$AB = 5 \sin 36 = \frac{5}{AD}$ $AD = \frac{5}{\sin 36}$ Or $\sin 36 = \frac{5}{BC}$ $BC = \frac{5}{\sin 36}$ $AD = BC$ OR $\cos 54 = \frac{5}{BC}$ $BC = \frac{5}{\cos 54}$	8.51	4	B1 $AB = 5$ M1 $\sin 36 = \frac{5}{AD}$ or $\sin 36 \frac{1}{5} = \sin 90 \frac{1}{AD}$ M1 $AD = \frac{5}{\sin 36}$ or $AD = \frac{5 \sin 90}{\sin 36}$ A1 8.5 – 8.51 OR M1 $\sin 36 = \frac{5}{BC}$ or $\sin 36 \frac{1}{5} = \sin 90 \frac{1}{BC}$ M1 $BC = \frac{5}{\sin 36}$ or $BC = \frac{5 \sin 90}{\sin 36}$ B1 $AD = BC$ A1 8.5 – 8.51 OR B1 angle $DCB = 54$ or angle $DBC = 36$ M1 $\cos 54 = \frac{5}{BC}$ M1 $BC = \frac{5}{\cos 54}$ A1 8.5 – 8.51 NB other methods such as tan + Pythagoras must be complete methods and will earn M2

Q12.

Question	Working	Answer	Mark	Notes
	$BD^2 + 12^2 = 16^2$ oe $BD = \sqrt{256 - 144}$ (=10.58...) $\sin 40 = \frac{10.58}{CD}$ $CD = \frac{10.58}{\sin 40}$	16.5	5	M1 for $BD^2 + 12^2 = 16^2$ oe or $16^2 - 12^2$ or 112 seen M1 for $\sqrt{256 - 144}$ or $\sqrt{112}$ (=10.58...) M1 for $\sin 40 = \frac{10.58}{CD}$ or $\cos 50 = \frac{10.58}{CD}$ M1 for $(CD =) \frac{10.58}{\sin 40}$ or $\frac{10.58}{\cos 50}$ A1 for 16.4 – 16.5 OR M1 for $BD^2 + 12^2 = 16^2$ oe or $16^2 - 12^2$ or 112 seen M1 for $\sqrt{256 - 144}$ or $\sqrt{112}$ (=10.58...) M1 for $(BC =) 10.58 \times \tan 50$ or $\frac{10.58}{\tan 40}$ (=12.6...) M1 for $\sqrt{12.6^2 + 10.58^2}$ A1 for 16.4 – 16.5

Q13.

	Working	Answer	Mark	Notes
		$5x^2$	4	<p>M1 for <math>4x \times 4x</math>  M1 for <math>(2x \times 4x)/2</math> or <math>(2x \times x)/2</math> or <math>(3x \times 4x)/2</math>  M1(dep M2) for "<math>16x^2</math>" – "<math>4x^2</math>" – "<math>x^2</math>" – "<math>6x^2</math>"  A1 for <math>5x^2</math></p> <p><b>OR</b>  M1 for <math>\sqrt{(2x)^2 + (4x)^2} (= \sqrt{20x^2} = \sqrt{20}x)</math>  M1 for <math>\sqrt{(x)^2 + (2x)^2} (= \sqrt{5x^2} = \sqrt{5}x)</math>  M1(dep M2) for <math>\frac{\sqrt{5}x \times \sqrt{20}x}{2} (= \frac{\sqrt{100}}{2}x^2)</math>  A1 for <math>5x^2</math></p>