

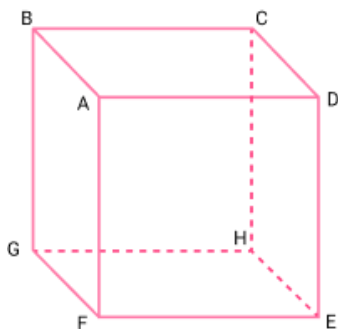
3D Trigonometry - Worksheet

Skill

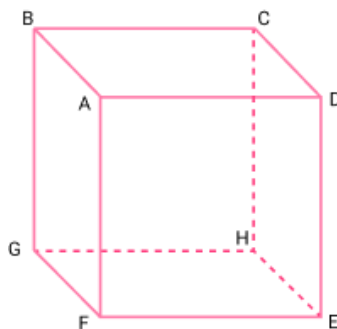
Group A - Visualising lines in 3D

Using the diagram provided, draw the lines highlighted in each question.

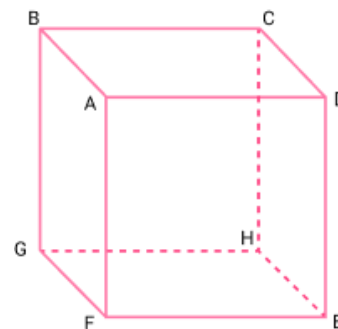
1) HF



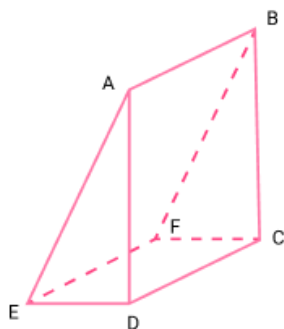
2) BE



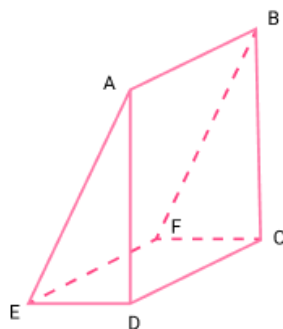
3) CG



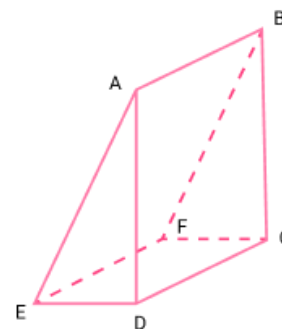
4) AC, CE



5) BD, DF

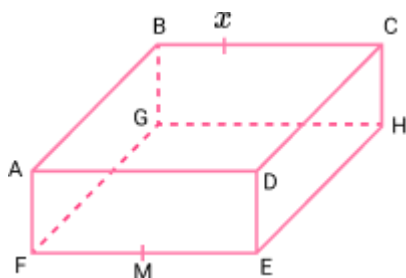


6) AF, EF

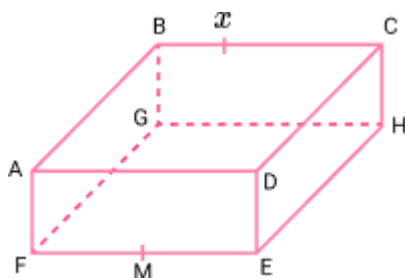


Using the diagram provided, draw the lines highlighted in each question. The point X divides the line BC in the ratio 1:3 and M is the midpoint of EF .

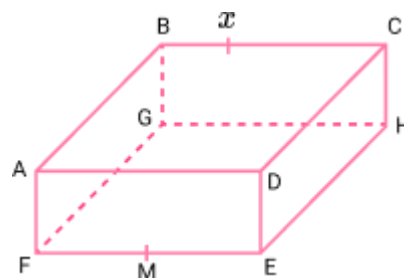
7) Dx, FX, DF



8) HX, MX, HM



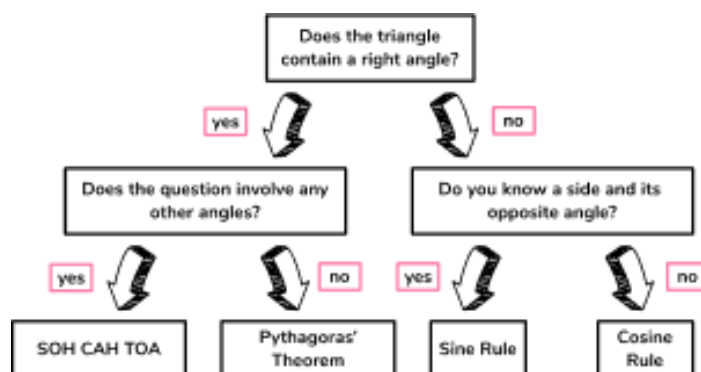
9) GD, DX, BX, BG



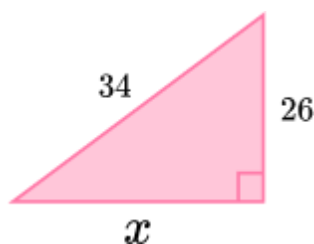
3D Trigonometry - Worksheet

Group B - Determine the rule/formula

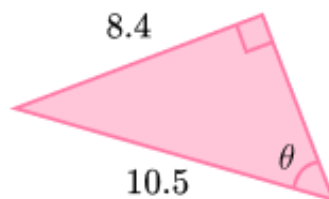
Use the flowchart to help you determine whether you need to use Pythagoras' Theorem / Trigonometric Ratios / The Sine Rule / The Cosine Rule to find the missing side or angle in each triangle.



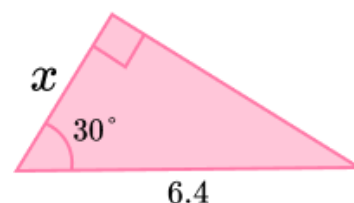
1)



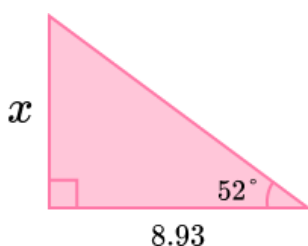
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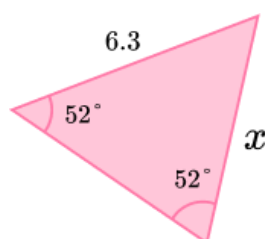
3)



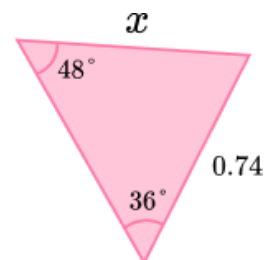
4)



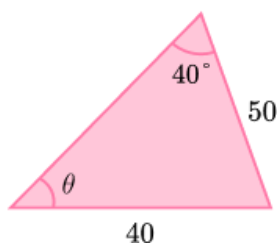
5)



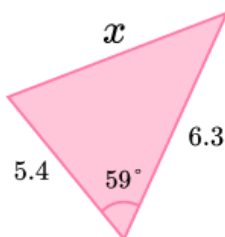
6)



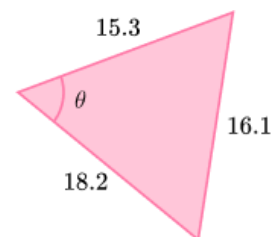
7)



8)



9)

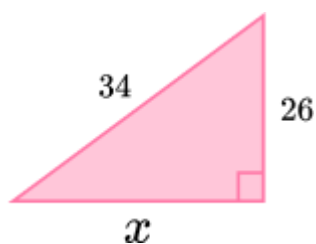


3D Trigonometry - Worksheet

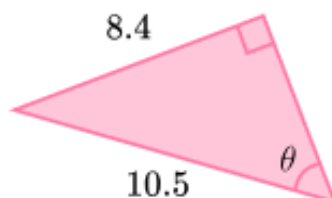
Group C - Find the missing side or angle

Use what you found in question 2 to calculate the value of x or θ for each triangle.

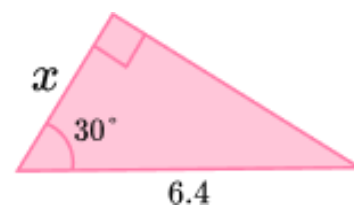
1) Calculate x



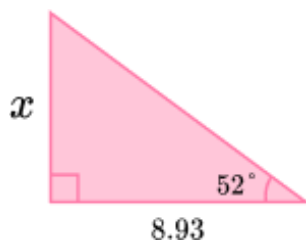
2) Calculate θ



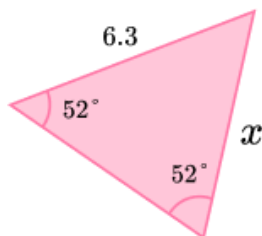
3) Calculate x



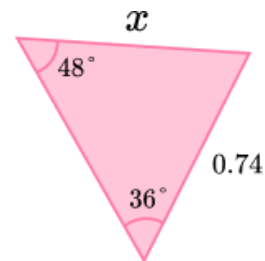
4) Calculate x



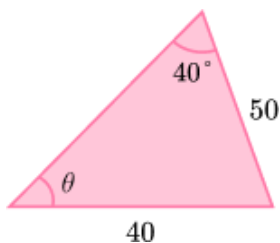
5) Calculate x



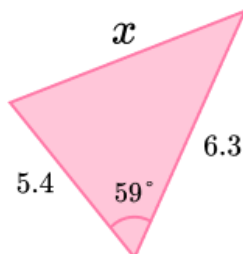
6) Calculate x



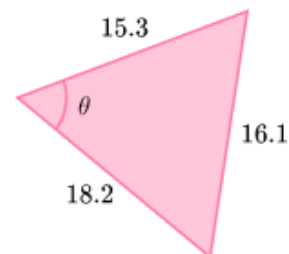
7) Calculate θ



8) Calculate x



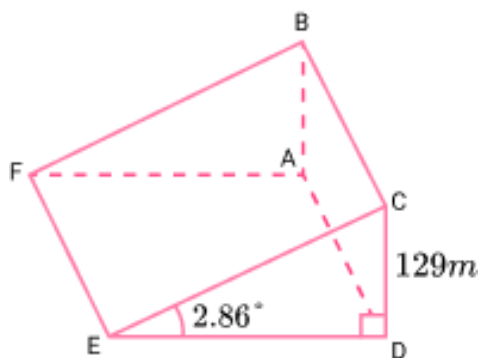
9) Calculate θ



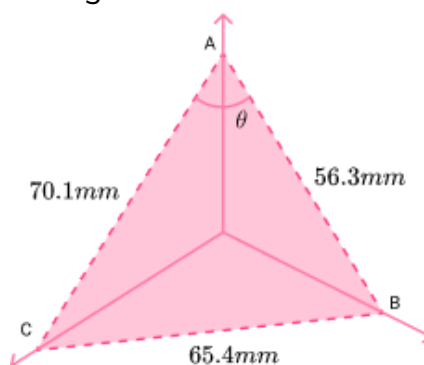
3D Trigonometry - Worksheet

Applied

- 1) Box Hill in Surrey is one of Britain's most iconic climbs. The average gradient of Box Hill is 5% or 2.86° . This is represented in the diagram below.



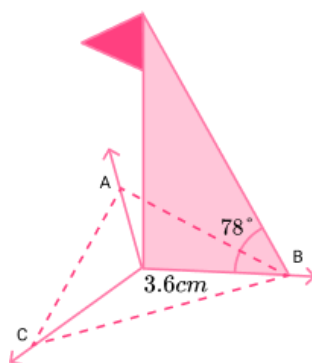
- (a) If the total height of the incline is $129m$, calculate the slope length CE . Write your answer in kilometres.
- (b) The angle $ECF = 60^\circ$. Calculate the distance CF in kilometres.
- 2) Three snails set off in different directions. After 10 minutes, their distance from each other is recorded. The diagram below shows the results.



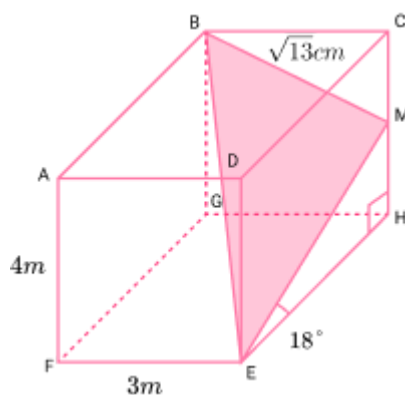
- (a) Calculate the angle CAB labelled θ to 2 decimal places.

3D Trigonometry - Worksheet

- (b) A flag is placed at the centre of the diagram. The angle of elevation of the top of the flag from snail B is 78° . If B travelled 3.6cm from the start line, calculate the height of the flagpole.



- 3) $ABCDEFGH$ is a cuboid. A tarpaulin is attached to the points E , B , and M . M is a midpoint on the line CH .



- (a) Calculate the length EM .
- (b) Calculate the length BE .
- (c) Calculate the length BME .

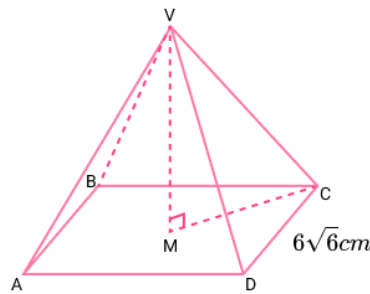
3D Trigonometry - Exam Questions

- 1) $VABCD$ is a square based pyramid.

$$\text{Angle } VMC = 90^\circ$$

$$\text{Angle } VCM = 60^\circ$$

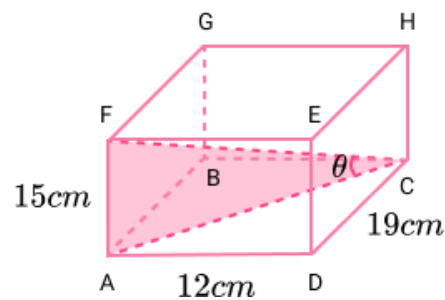
$$CD = 6\sqrt{6}$$



Calculate the vertical height of the pyramid VM .

.....
(5 marks)

- 2) Shape $ABCDEFGH$ is a cuboid.

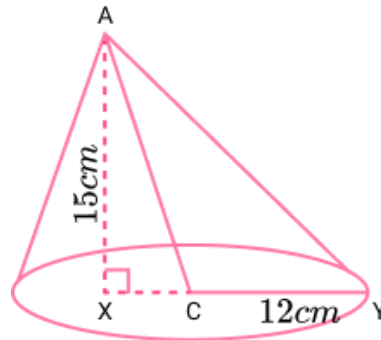


Using the information on the diagram, calculate the size of angle ACF labelled θ . Show all your working.

.....
(4 marks)

3D Trigonometry - Exam Questions

- 3) The diagram below shows a cone with the apex A , 15cm directly above X . The radius of the base is 12cm . XY is a straight line through the centre C , and the displacement of X from C is 8cm .



- (a) Using this information, calculate the angle XCA correct to 3 significant figures.

.....
(3)

- (b) Calculate the length AY .

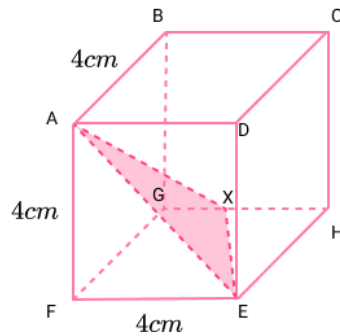
.....
(3)

- (c) Use your answers to part (a) and (b) to find the angle CAY .

.....
(3)
(9 marks)

3D Trigonometry - Exam Questions

- 4) $ABCDEFGH$ is a cube with side length 4 cm . The point X lies on the line GH where $GX:XH = 1:3$.



- (a) Calculate the length of EX .

.....
(3)

- (b) Calculate the length of AX .

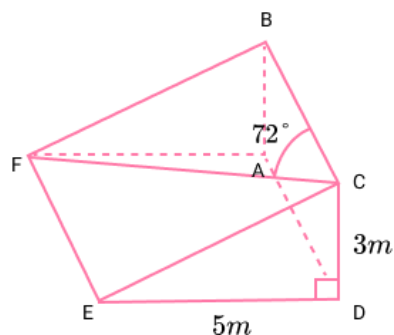
.....
(6)

- (c) Given that the length of $AE = 4\sqrt{2}\text{ cm}$, use your answers to part a) and b) to calculate the size of the angle AEX to 3 significant figures.

.....
(4)
(13 marks)

3D Trigonometry - Exam Questions

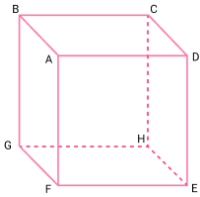
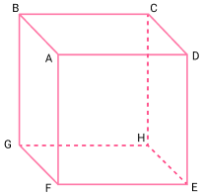
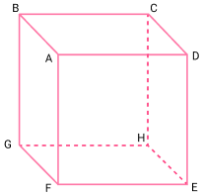
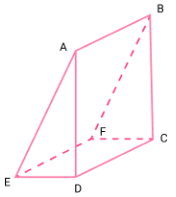
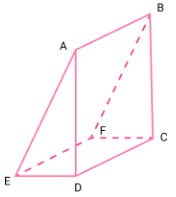
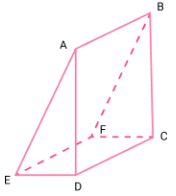
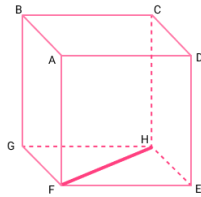
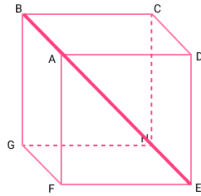
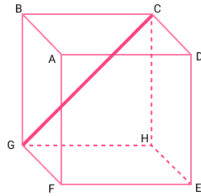
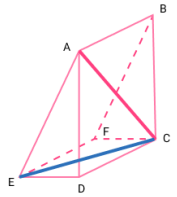
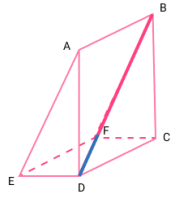
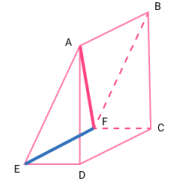
- 5) The ramp $ABCDEF$ is a triangular prism. $BCEF$ is a rectangle.



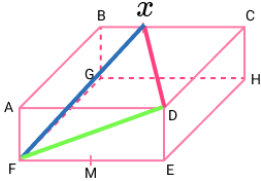
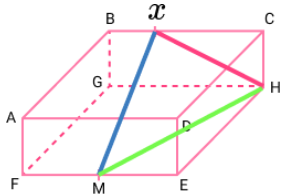
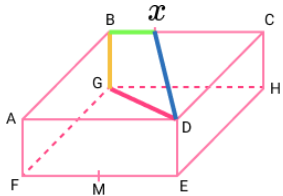
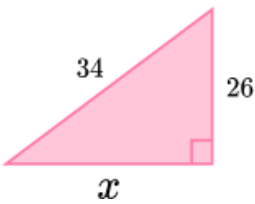
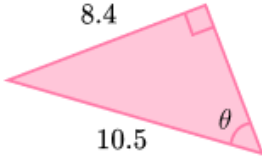
Calculate the length of the line CF .

.....
(5 marks)

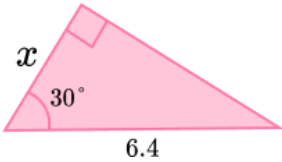
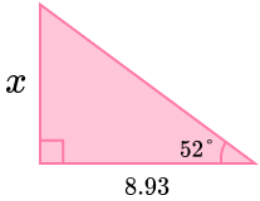
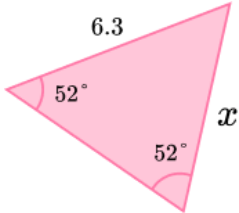
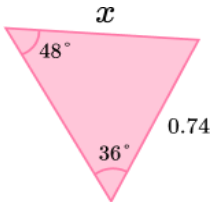
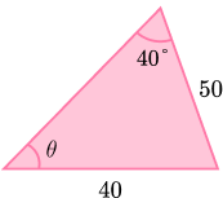
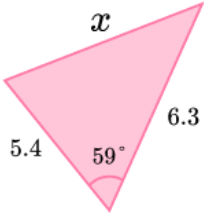
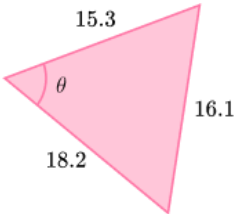
3D Trigonometry - Answers

	Question	Answer
	Skill Questions	
Group A	<p>Using the diagram provided, draw the lines highlighted in each question.</p> <p>1) HF</p>  <p>2) BE</p>  <p>3) CG</p>  <p>4) AC, CE</p>  <p>5) BD, DF</p>  <p>6) AF, EF</p> 	<p>1)</p>  <p>2)</p>  <p>3)</p>  <p>4)</p>  <p>5)</p>  <p>6)</p> 

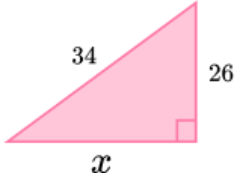
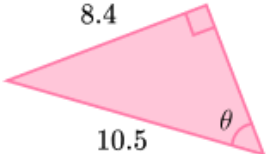
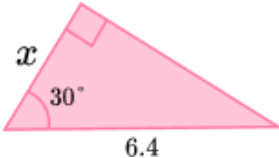
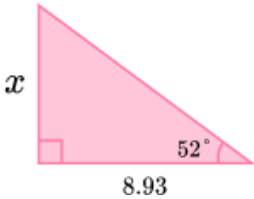
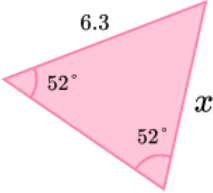
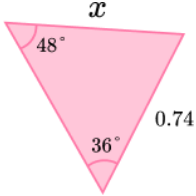
3D Trigonometry - Answers

<p>Group A contd</p>	<p>Using the diagram provided, draw the lines highlighted in each question. The point x divides the line BC in the ratio 1: 3 and M is the midpoint of EF.</p> <p>7) DX, FX, DF</p> <p>8) HX, MX, HM</p> <p>9) GD, DX, BX, BG</p>	<p>7)</p>  <p>8)</p>  <p>9)</p> 
<p>Group B</p>	<p>Use the flowchart to help you determine whether you need to use Pythagoras' Theorem / Trigonometric Ratios / The Sine Rule / The Cosine Rule to find the missing side or angle in each triangle.</p> <p>1)</p>  <p>2)</p> 	<p>1) Pythagoras' Theorem</p> <p>2) SOHCAHTOA</p>

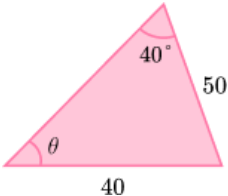
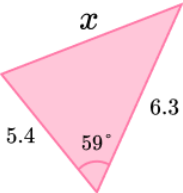
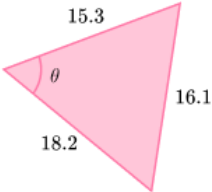
3D Trigonometry - Answers

Group B	<p>3)</p>  <p>4)</p>  <p>5)</p>  <p>6)</p>  <p>7)</p>  <p>8)</p>  <p>9)</p> 	<p>3) SOHCAHTOA</p> <p>4) SOHCAHTOA</p> <p>5) Sine Rule</p> <p>6) Sine Rule</p> <p>7) Sine Rule</p> <p>8) Cosine Rule</p> <p>9) Cosine Rule</p>
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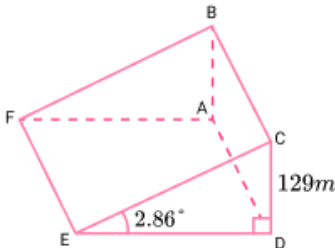
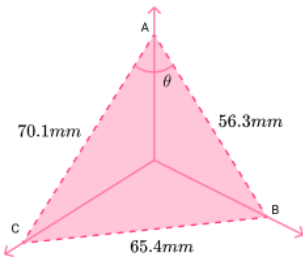
3D Trigonometry - Answers

Group C	<p>Use what you found in question 2 to calculate the value of x or for each triangle.</p> <p>1) Calculate x</p>  <p>2) Calculate θ</p>  <p>3) Calculate x</p>  <p>4) Calculate x</p>  <p>5) Calculate x</p>  <p>6) Calculate x</p> 	<p>1) $4\sqrt{30}$</p> <p>2) 53.130°</p> <p>3) $\frac{16\sqrt{3}}{5}$</p> <p>4) 11.4299</p> <p>5) 6.3</p> <p>6) 0.5853</p>
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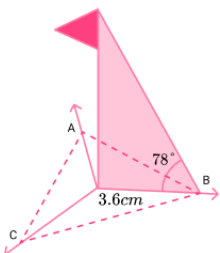
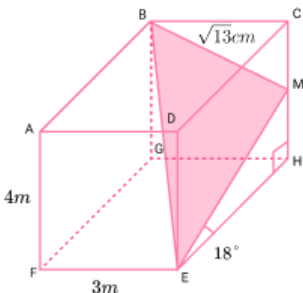
3D Trigonometry - Answers

Group C contd	<p>7) Calculate θ</p>  <p>8) Calculate x</p>  <p>9) Calculate θ</p> 	<p>7) 53.46°</p> <p>8) 5.81</p> <p>9) 56.6559°</p>
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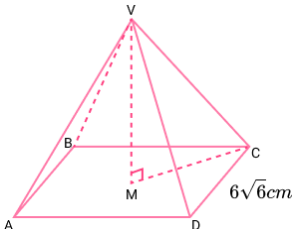
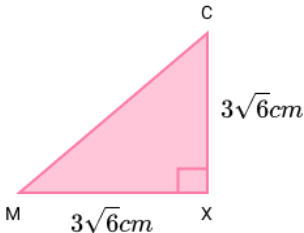
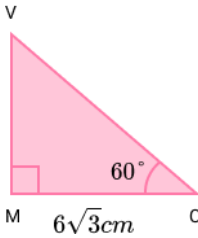
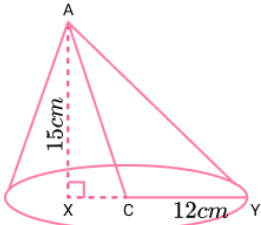
3D Trigonometry - Answers

	Question	Answer
	Applied Questions	
1)	<p>Box Hill in Surrey is one of Britain's most iconic climbs. The average gradient of Box Hill is 5% or 2.86°. This is represented in the diagram below.</p>  <p>a) If the total height of the incline is 129 m, calculate the slope length CE. Write your answer in kilometres.</p> <p>b) The angle $ECF = 60^\circ$. Calculate the distance CF in kilometres.</p>	<p>a) 2.585 km</p> <p>b) 5.17 km</p>
2)	<p>Three snails set off in different directions. After 10 minutes, their distance from each other is recorded. The diagram below shows the results.</p>  <p>a) Calculate the angle CAB labelled θ to 2 decimal places.</p>	<p>a) 61.17°</p>

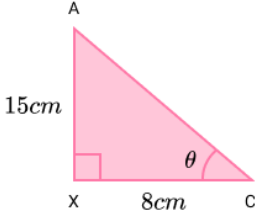
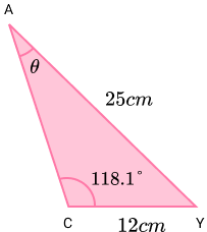
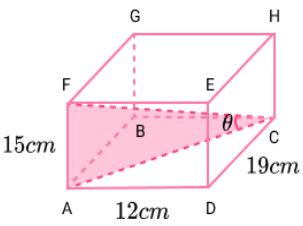
3D Trigonometry - Answers

	<p>b) A flag is placed at the centre of the diagram. The angle of elevation of the top of the flag from snail B is 78°. If B travelled 3.6 cm from the start line, calculate the height of the flagpole.</p> 	<p>b) 16.94 cm</p>
<p>3)</p>	<p>$ABCDEFGH$ is a cuboid. A tarpaulin is attached to the points E, B, and M. M is a midpoint on the line CH.</p>  <p>a) Calculate the length EM.</p> <p>b) Calculate the length BE.</p> <p>c) Calculate the angle BME.</p>	<p>a) 6.472 cm</p> <p>b) 7.93 cm</p> <p>c) 99.9°</p>

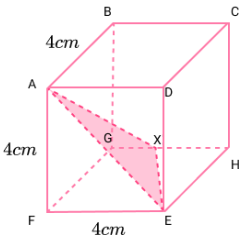
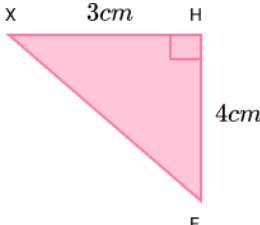
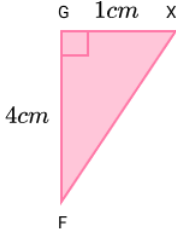
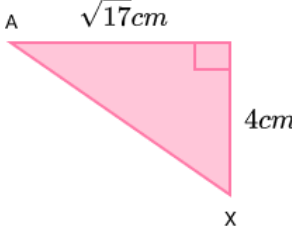
3D Trigonometry - Mark Scheme

	Question	Answer
	Exam Questions	
1)	<p>$VABCD$ is a square based pyramid.</p> <p>Angle $VMC = 90^\circ$</p> <p>Angle $VCM = 60^\circ$</p> <p>$CD = 6\sqrt{6}$</p>  <p>Calculate the vertical height of the pyramid VM.</p>	<p>Right angle triangle drawn:</p>  <p>Find the hypotenuse (CM):</p> $(3\sqrt{6})^2 + (3\sqrt{6})^2 = CM^2$ $CM = \sqrt{108} \text{ or } 6\sqrt{3}$ <p>New triangle drawn:</p>  <p>or $\tan(60) = \frac{VM}{6\sqrt{3}}$</p> $VM = 18\text{cm}$ <div style="text-align: right;"> <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p> </div>
2)	<p>The diagram below shows a cone with the apex A, 15 cm directly above X. The radius of the base is 12 cm. XY is a straight line through the centre C, and the displacement of X from C is 8 cm.</p> 	

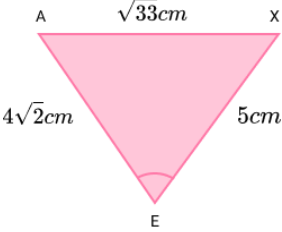
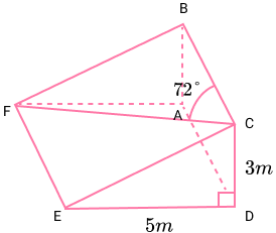
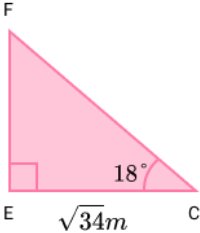
3D Trigonometry - Mark Scheme

(a)	Using this information, calculate the angle XCA correct to 3 significant figures.	<p>(a) Right angle triangle drawn:</p>  $\tan^{-1}\left(\frac{15}{8}\right) = \theta$ $\theta = 61.9^\circ \text{ (3sf)}$	<p>(1)</p> <p>(1)</p> <p>(1)</p>
(b)	Calculate the length AY .	<p>(b) $AY^2 = 20^2 + 15^2$</p> $AY^2 = 625$ $AY = 25 \text{ cm}$	<p>(1)</p> <p>(1)</p> <p>(1)</p>
(c)	Use your answers to part a) and b) to find the angle CAY .	<p>(c) Triangle drawn:</p>  $\frac{\sin(118.1)}{25} = \frac{\sin(\theta)}{12}$ $\theta = 25.1^\circ$	<p>(1)</p> <p>(1)</p> <p>(1)</p>
3)	<p>Shape $ABCDEFGH$ is a cuboid.</p>  <p>Using the information on the diagram, calculate the size of angle ACF labelled θ. Show all your working.</p>	$19^2 + 12^2 = 505$ $AC = \sqrt{505}$ $\theta = \tan^{-1}\left(\frac{15}{\sqrt{505}}\right)$ $\theta = 33.72^\circ$	<p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p>

3D Trigonometry - Mark Scheme

<p>4)</p> <p>(a)</p>	<p>$ABCDEFGH$ is a cube with side length 4 cm. The point X lies on the line GH where $GX:XH = 1:3$.</p> 	<p>(a) Triangle drawn:</p>  $EX^2 = 3^2 + 4^2$ $EX = 5\text{ cm}$	<p>(1)</p> <p>(1)</p> <p>(1)</p>
<p>(b)</p>	<p>Calculate the length of AX.</p>	<p>(b) Triangle drawn:</p>  $FX^2 = 1^2 + 4^2$ $FX = \sqrt{17}\text{ cm}$ <p>Triangle drawn:</p>  $AX^2 = \sqrt{17}^2 + 4^2$ $AX = \sqrt{33}\text{ cm}$	<p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p>

3D Trigonometry - Mark Scheme

(c)	<p>Given that the length of $AE = 4\sqrt{2} \text{ cm}$, use your answers to part a) and b) to calculate the size of the angle AEX to 3 significant figures.</p>	<p>(c) Triangle drawn:</p>  <p>Cosine rule stated: $A = \cos^{-1}\left(\frac{b^2 + c^2 - a^2}{2bc}\right)$</p> <p>$\theta = \cos^{-1}\left(\frac{32 + 25 - 33}{2 \times 5 \times 4\sqrt{2}}\right) = \cos^{-1}(0.424\dots)$</p> <p>$\theta = 64.9^\circ \text{ (3sf)}$</p>	<p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p>
5)	<p>The ramp $ABCDEF$ is a triangular prism. $BCEF$ is a rectangle.</p>  <p>Calculate the length of the line CF.</p>	<p>$BD^2 = 3^2 + 5^2$</p> <p>$BD = \sqrt{34}$</p> <p>Triangle drawn:</p>  <p>$CF = \frac{\sqrt{34}}{\cos(18)}$</p> <p>$CF = 6.13 \text{ m}$</p>	<p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p>

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