

Question	Scheme	Marks
9	<p>Be careful to look on the sketch to award marks for the question and for any equivalent calculations or alternative methods. IF IN DOUBT SEND TO REVIEW X is the point directly below V positioned on the base $ABCDE$ Perpendicular from the mid-point of BC (M) to point X</p> <p>$(\angle BXC =) 72^\circ$ or $(\angle ABC =) 108^\circ$</p> <p>Length of BX eg $(BX =) \frac{x}{\sin 36^\circ} (= 1.701x)$ or $\frac{\sin 54}{\sin 72} \times 2x$ or $\frac{x}{\cos 54}$ oe</p> <p>$(VX =) \sqrt{(3x)^2 - (1.701x)^2} = 2.471x$ or $(VM =) \sqrt{(3x)^2 - (x)^2} = \sqrt{8}x (= 2.828x)$</p> <p>$(MX =) \sqrt{(1.701x)^2 - x^2} = 1.376x$ or $\frac{x}{\tan 36}$ oe or $x \tan 54$</p> <p>Required angle is $\angle VMX$ or $\angle VME$ $(\tan \angle VMX =) \frac{2.471x}{1.376x} \Rightarrow (\angle VMX = 60.888...^\circ)$ oe $(\cos \angle VME =) \frac{(\sqrt{8}x)^2 + (1.701x + 1.376x)^2 - (3x)^2}{2 \times \sqrt{8}x \times (1.701x + 1.376x)}$ oe \Rightarrow awrt 60.9° or better</p>	<p>B1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>dddM1</p> <p>A1 [6]</p>
ALT1	<p>May only be applied if they attempt to find MX in one step and attempt to find VM and use triangle VMX. If they find MX any other way, apply one of the other schemes $(\angle BXC =) 72^\circ$ or $(\angle ABC =) 108^\circ$</p> <p>$(MX =) \frac{x}{\tan 36}$ oe or $x \tan 54$</p> <p>$(VM =) \sqrt{(3x)^2 - (x)^2} = \sqrt{8}x (= 2.828x)$</p> <p>$(\cos \angle VMX =) \frac{x \tan 54}{2\sqrt{2}x} \Rightarrow (\angle VMX = 60.888...^\circ)$ \Rightarrow awrt 60.9° or better</p>	<p>B1</p> <p>M2</p> <p>M1</p> <p>dddM1</p> <p>A1 [6]</p>

ALT2	$(\angle BXC =) 72^\circ \text{ or } (\angle ABC =) 108^\circ$	B1
	$(EB =) \sqrt{(2x)^2 + (2x)^2 - 2(2x)(2x)\cos 108} (= 3.236x)$	
	or $(EB =) \frac{2x}{\sin 36} \times \sin 108 (= 3.236x)$	M1
	$(VM =) \sqrt{(3x)^2 - (x)^2} = \sqrt{8}x (= 2.828x)$	M1
	$(EM =) \sqrt{("3.236x")^2 - x^2} (= 3.077x)$	M1
	$(\cos \angle VME =) \frac{(" \sqrt{8}x ")^2 + ("1.701"x + "1.376"x)^2 - (3x)^2}{2 \times " \sqrt{8}x " \times ("1.701"x + "1.376"x)}$	dddM1
	$\Rightarrow \text{awrt } 60.9^\circ \text{ or better}$	A1
		[6]
Total 6 marks		

Mark	Notes
B1	For writing down or finding the angle $BXC = 72^\circ$ or $\angle ABC = 108^\circ$, any notation. Clear identification or implicit use of this angle in later working is acceptable. Note use of 36 degrees or 54 degrees implied this mark.
M1	Ignore missing x 's throughout their solution. For any correct, suitable trigonometry to find the length BX
M1	Correct use of Pythagoras theorem (with a – sign) or suitable trigonometry to find the height VX of the pyramid or the length VM
M1	Correct use of Pythagoras theorem (with a – sign) or suitable trigonometry to find the length of the midpoint of BC to point X
dddM1	For any suitable trigonometry to find the size of the required angle. Dependent on all 3 previous method marks.
A1	For the correct angle, awrt 60.9°
ALT1 B1	For writing down or finding the angle $BXC = 72^\circ$ or $\angle ABC = 108^\circ$, any notation. Clear identification or implicit use of this angle in later working is acceptable. Note use of 36 degrees or 54 degrees implied this mark.
M2	Ignore missing x 's throughout their solution. For any correct method to find the length MX
M1	Correct method to find the length VM
dddM1	For any suitable trigonometry to find the size of the required angle. Dependent on all 3 previous method marks.
A1	For the correct angle, awrt 60.9°
ALT2 B1	For writing down or finding the angle $BXC = 72^\circ$ or $\angle ABC = 108^\circ$, any notation. Clear identification or implicit use of this angle in later working is acceptable. Note use of 36 degrees or 54 degrees implied this mark.
M1	Ignore missing x 's throughout their solution. For any correct method to find the length EB
M1	For any correct method to find VM
M1	For any correct method to find EM
dddM1	For any suitable trigonometry to find the size of the required angle. Dependent on all 3 previous method marks.
A1	For the correct angle, awrt 60.9°
Where students are allowed to use their values, indicated by inverted commas, it MUST be clear from working or their sketch this is the correct use of the relevant side. Beware $\sqrt{8x}$ coming from incorrect working of $\sqrt{(2x)^2 + (2x)^2}$	

