

Question	Working	Answer	Mark	Notes
4	$(1 - 0.64) \times 75$ or $0.64 \times 75$ or $75 - 0.64 \times 75$ oe			M1
		27	2	A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
Total 2 marks				
5	Method 1	Method 2		
	$2y = 17$ oe	$4x = -16$ oe		M1 Eliminating either $x$ or $y$ to get a correct equation in one unknown
	$4x + 4 \times "8.5" = 18$ or $4x = -16$	$4 \times (" - 4") + 6y = 35$ or $2y = 17$		M1 Subst their $x$ or $y$ value into either equation or start again. If M1 has already been awarded this can be implied by a correct value for $x$ <b>and</b> $y$ . <b>NB</b> The Speech marks around the $-4$ (" $-4$ ") means this follows through from their value
		$x = -4$ $y = 8.5$	3	A1 dep on 1 <sup>st</sup> M1 being awarded
Total 3 marks				
6	$[AD =] \sqrt{25^2 - (50 - 35)^2} [= 20]$			M1 Correct calculation to find $AD$ or $[AD =] 20$ Allow using their $h = (50 - 35)$ if marked on their diagram provided $h$ is between 5 and 25. Must see the Pythagoras calculation eg $\sqrt{25^2 - 18^2}$ <b>NB</b> Anything appearing in square brackets is not required
	[Perimeter =] $50 + 25 + 35 + "20"$			M1 dep on previous method mark being awarded. Follow through their "20".
		130	3	A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
Total 3 marks				

Question	Working	Answer	Mark	Notes	
7	Sight of $3n$ or $3n - 8$ or $n + 20$			M1	One correct expression seen. May be seen as part of an equation
	$n + 20 = 3n - 8$ oe			A1	Correct equation
		14	3	A1	dep on previous A mark awarded
Total 3 marks					
8	Arc, centred $B$ , radius 4 cm, drawn within $ABCD$			M1	Ignore any parts outside of $ABCD$ . Arc drawn should lie between an arc radius 3.8 cm and arc radius 4.2 cm. It should intersect $AB$ and $BC$ and be complete within $ABCD$
	2 pairs of intersecting arcs of equal radius centred at $A$ and $D$ with line drawn through intersection points oe			M1	Ignore any parts outside of $ABCD$ . Construction lines <b>must</b> be shown. Line should lie between 4.3 cm and 4.7cm from $AB$ .
		$R$ identified by shading and labelled	3	A1	dep on both previous method marks awarded. Allow just shading or just $R$ if it is clear which the area is.
Total 3 marks					
9	$\frac{27}{1.08}$ or $\frac{27}{108} \times 100$ [=25]			M1	For a correct method to find the original price.
	" $\frac{27}{1.08}$ " $\times 1.35$ or " $\frac{27}{108} \times 100$ " + " $\frac{35}{100} \times 25$ " oe			M1	dep on previous method mark being awarded. For a correct method to increase their original price by 35%
		33.75	3	A1	oe Working not required, so correct answer scores full marks (unless from obvious incorrect working)
Total 3 marks					

Question	Working	Answer	Mark	Notes
10	$28 = 2 \times 2 \times 7$ or $4 \times 7$ $120 = 2 \times 2 \times 2 \times 3 \times 5$ or $4 \times 30$ oe Or factor trees <div> <div> <div></div> <div>2</div> </div> <div> <div>28</div> <div>120</div> </div> </div> <div> <div>14</div> <div>60</div> </div> <div> <div>2</div> <div>7</div> </div> <div> <div>30</div> </div>			M1 For prime factorisation of 28 and 120 (may be at ends of a factor tree), must have $2 \times 2 \dots$ or $4 \times \dots$  or for multiples of 120 up to at least 840 or for multiples of 28 up to at least 840
	LCM (28, 120) = 840			A1 Allow $2 \times 2 \times 2 \times 3 \times 5 \times 7$
		843	3	A1ft For adding 3 to their LCM. The M1 must be awarded. An answer with no working gains no marks
Total 3 marks				
11	$(68 - 32) \times 34$ or $(32 + x) \times 42$ oe			M1 Calculating the cost for either <i>R</i> or <i>C</i> . May be seen as part of a calculation
	$(68 - 32) \times 34 + (32 + x) \times 42 = 3702$ or $\frac{3702 - 36 \times 34 - 32 \times 42}{42}$ oe			M1 Setting up a correct equation or expression.
		27	3	A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
Total 3 marks				

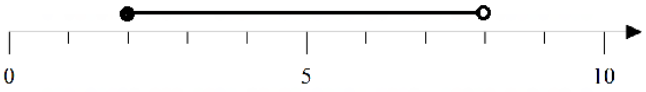
Question	Working	Answer	Mark	Notes
12	$\frac{4(x-6)-3(8x+2)}{12}$ oe			M1 Correct method to reduce to a single fraction. Condone invisible brackets if multiplied out correctly with one sign error only. Implied by next M1
	$\frac{4x-24-24x-6}{12}$ oe			M1 Multiplying out correctly (allow one sign error if 4 terms given - if incorrect answer this line must be seen) If M1 has already been awarded this can be implied by a correct answer
		$\frac{-10x-15}{6}$	3	A1 oe with denominator of 6 or -6 Dependent on both M marks being awarded.
<b>Total 3 marks</b>				

13	$\angle BAE = \angle CDE$ <b>angles</b> in the <b>same segment</b> OR <b>angles</b> at the circumference <b>subtend</b> from the same <b>arc</b> of the circle			Allow $BAC$ and $CDB$ Do not accept other notations such as $\hat{A}$ and $\hat{D}$
	$\angle ABE = \angle DCE$ <b>angles</b> in the <b>same segment</b> OR <b>angles</b> at the circumference <b>subtend</b> from the same <b>arc</b> of the circle			Allow $ABD$ and $DCA$ Do not accept other notations such as $\hat{B}$ and $\hat{C}$
	$\angle BEA = \angle CED$ <b>vertically opposite</b> angle OR <b>vertically opposite angle</b>			M2 For two correct corresponding pairs of angles with at least one correct reason. Words in bold needed. Allow $\angle$ for angles (Allow M1 for 2 correct corresponding pair of angles)
		Two/Three angles are equal therefore $ABE$ is similar to $DCE$	3	A1 A correct conclusion and 2 corresponding angles stated equal with correct reason for both angles. Ignore a third angle given even if incorrect. Allow Two/Three angles are equal therefore similar
<b>Total 3 marks</b>				

Question	Working	Answer	Mark	Notes
14	$[AX =] \sqrt{4^2 + 4^2} [= \sqrt{32} \text{ or } 5.656\dots] \text{ oe}$			M1 Allow $[AX =] \frac{1}{2} \sqrt{8^2 + 8^2}$
	$\tan(\angle EAX) = \frac{15}{\sqrt{4^2 + 4^2}}$			M1 dep on previous M mark being awarded. A correct method to find $\angle EAX$ eg using $\tan(\angle AEX) = \frac{\sqrt{4^2 + 4^2}}{15}$ <b>and</b> $\angle EAX = 90 - \angle AEX$
		69.3	3	A1 awrt 69.3 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
<b>Alternatives for the 2<sup>nd</sup> M1</b>				
$[AE =] \sqrt{\sqrt{(4^2 + 4^2)^2} + 15^2} [= \sqrt{257}]$ <b>and</b> $\sin EAX = \frac{15}{\sqrt{257}}$ or $\sin EAX = \frac{15 \sin 90}{\sqrt{257}}$ or $\cos EAX = \frac{\sqrt{32}}{\sqrt{257}}$				
$[AE =] \sqrt{\sqrt{(4^2 + 4^2)^2} + 15^2} [= \sqrt{257}]$ <b>and</b> $\angle EAX = 90 - \angle AEX$ <b>and</b> $\sin AEX = \frac{\sqrt{32}}{\sqrt{257}}$ or $\sin AEX = \frac{\sqrt{32} \sin 90}{\sqrt{257}}$ or $\cos AEX = \frac{15}{\sqrt{257}}$				
$[AE =] \sqrt{\sqrt{(4^2 + 4^2)^2} + 15^2} [= \sqrt{257}]$ <b>and</b> $\cos(\angle EAX) = \left( \frac{257 + 32 - 15^2}{2 \times \sqrt{257} \times \sqrt{32}} \right)$				
$[AE =] \sqrt{\sqrt{(4^2 + 4^2)^2} + 15^2} [= \sqrt{257}]$ <b>and</b> $\cos(\angle AEX) = \frac{257 + 15^2 - 32}{2 \times \sqrt{257} \times 15}$ <b>and</b> $\angle EAX = 90 - \angle AEX$				
<b>Alternative for M1M1 -Finding EA from triangle EAD</b>				
M1 $[AE =] \sqrt{\sqrt{(4^2 + 15^2)^2} + 4^2} [= \sqrt{257}]$ M1dep $\sin EAX = \frac{15}{\sqrt{257}}$ or $\sin EAX = \frac{15 \sin 90}{\sqrt{257}}$ or another correct method to find $EAX$				
<b>Total 3 marks</b>				

Question	Working	Answer	Mark	Notes
15	$\frac{4-\sqrt{12}}{4+\sqrt{12}} \times \frac{4-\sqrt{12}}{4-\sqrt{12}}$ oe			M1 multiplying by $\frac{4-\sqrt{12}}{4-\sqrt{12}}$ or $\frac{2-\sqrt{3}}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ or $\frac{4-\sqrt{12}}{4-\sqrt{12}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ oe
	$\frac{16+12-8\sqrt{12}}{16-12}$ or $\frac{28-8\sqrt{12}}{4}$ oe			M1 multiplies out correctly but need not be simplified. Allow $\frac{4+3-4\sqrt{3}}{4-3}$ or $\frac{7-4\sqrt{3}}{1}$ or $7-4\sqrt{3}$ or $\frac{14-2\sqrt{12}-4\sqrt{3}}{2+2\sqrt{12}-4\sqrt{3}}$ oe
		$7-\sqrt{48}$	3	A1 dep on both the previous method marks being awarded. Correct answer with no working is no marks. Allow $a=7$ and $b=48$ ISW once $7-\sqrt{48}$ seen <b>NB</b> Do not allow for $7-4\sqrt{3}$ unless $7-\sqrt{48}$ seen in working
<b>Total 3 marks</b>				

16(a)	$25a^4b^6$			M1 Any 2 terms correct $25a^4 \dots$ or $\dots a^4b^6$ or $25 \dots b^6$
		$25a^4b^6$	2	A1
(b)	$\frac{3x^2y^1}{3x^2y^{-4}}$ or $\frac{y^1}{y^{-4}}$			M1 Allow $y$ for $y^1$
		$y^5$	2	A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
<b>Total 4 marks</b>				

17(a)	$10 \leq 5x$ or $x < 8$ oe			M1 Condone $10 < 5x$ and $x \leq 8$
	$10 \leq 5x$ and $x < 8$ oe			M1 Correct inequality signs must be used.
		$2 \leq x < 8$	3	A1 oe ISW Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow $[2,8)$ or other notation eg $\{x : 2 \leq x < 8\}$
(b)			1	B1 ft their inequality if answer to (a) is in the form $a \leq x < b$ or $a < x \leq b$ (one closed dot one open dot – do not accept alternative notation)

**Total 4 marks**

Question	Working	Answer	Mark	Notes
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18	$[AD] = \frac{25}{\tan 33} - 20 [= 18.496...]$			M1 A correct method to find $AD$ eg $25 \tan 57 - 20$ Must use correct angle.	
	$\tan(\angle DBA) = \frac{"18.496..."}{25} [\angle DBA = 36.496]$			M1 dep on previous M mark awarded Allow use of their $AD$ (maybe marked on the diagram)	M2 for $\tan(\angle BDA) = \left( \frac{25}{"18.496"} \right)$
	Angle of depression = $90 - "36.49..."$			M1 dep on previous M mark awarded.	
		53.5	4	A1 awrt 53.5 Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow marked on diagram if clearly the angle of depression.	
Alt 1	$[AD] = \frac{25}{\tan 33} - 20 [= 18.496...]$			M1 A correct method to find $AD$ eg $25 \tan 57 - 20$ Must use correct angle	
	$[BD] = \sqrt{25^2 + "18.496..."^2} [= 31.098...] \text{ and }$ $\cos \angle DBA = \frac{25}{"31.098..."} \text{ or }$ $\sin \angle DBA = \frac{"18.496..."}{"31.098..."}$			M1 dep on previous M mark awarded Allow use of their $AD$ if clearly labelled or marked on the diagram for $AD$ . Also allow use of their "31.098..."	M2 for $BD = \sqrt{25^2 + "18.496..."^2} [= 31.098...]$ <b>and</b> $\cos \angle BDA = \frac{"18.496..."}{"31.098..."} \text{ or }$ $\sin \angle BDA = \frac{25}{"31.098..."} \text{ oe }$
	Angle of depression = $90 - 36.49...$			M1 dep on previous M mark awarded	
		53.5	4	A1 awrt 53.5 Allow marked on diagram if clearly the angle of depression.	
Alt 2	$[AD] = \frac{25}{\tan 33} - 20 [= 18.496...]$			M1 A correct method to find $AD$ eg $25 \tan 57 - 20$ Must use correct angle	
	$\cos \angle CBD = \frac{(25^2 + (20 + "18.496...")^2) + (25^2 + 18.496...^2) - 20^2}{2 \times \sqrt{25^2 + (20 + "18.496...")^2} \times \sqrt{(25^2 + 18.496...^2)}}$			M1 dep on previous M mark awarded. Allow use of their $AD$ if their value of $AD$ is labelled or marked on the diagram for $AD$	
	Angle of depression = $33 + "20.51..."$			M1 dep on previous M mark awarded	
		53.5	4	A1 awrt 53.5 Allow marked on diagram if clearly the angle of depression.	
<b>Total 4 marks</b>					
<b>NB:</b> Allow use of sine or cosine rule for calculations on triangle $ABD$ or $ACB$ but need to rearrange to get $\cos \angle BDA$ etc					
<b>Question</b>	<b>Working</b>	<b>Answer</b>	<b>Mark</b>	<b>Notes</b>	

19	$\frac{1}{2}y\sqrt{y^2 - \left(\frac{1}{2}y\right)^2} \left[ = \frac{\sqrt{3}}{4}y^2 \right]$			M1 Correct method for finding the area of the triangle eg $\frac{1}{2}y^2 \sin 60$ or $\frac{1}{2}y^2 \cos 30$ or $\frac{y^2}{4} \tan 60$ or $\frac{y^2}{4 \tan 30}$ oe or Heron's formula
	$\sqrt{3}x^2 = \frac{1}{2}y\sqrt{y^2 - \left(\frac{1}{2}y\right)^2} \quad [\Rightarrow 2x = y] \text{ oe}$			M1 dep on previous M being awarded. Equating the area of the rectangle to the area of the triangle eg $\sqrt{3}x^2 = \frac{1}{2}y^2 \sin 60$
	$2x + 2\sqrt{3}x : 3 \times "2x" \text{ or } "y" + "y" \sqrt{3} : 3y$			M1 A correct ratio un-simplified. Allow multiples. Allow $2x + 2\sqrt{3}x : 3 \times y$ where $y$ is a function of $x$ based on their equation or $2x(1 + \sqrt{3}) : 3y$ where $x$ is a function of $y$ based on their equation.
		$(1 + \sqrt{3}) : 3$	4	A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow $a = 1$ and $b = 3$
<b>Total 4 marks</b>				

20	$[m_{\text{LB}} =] 5075, [m_{\text{UB}} =] 5085 [d_{\text{LB}} =] 8.725, [d_{\text{UB}} =] 8.735$ $[r_{\text{LB}} =] 8.45, [r_{\text{UB}} =] 8.55$			B1 For one correct LB or UB stated or used.
	Volume = $\frac{1}{3} \times 3.142 \times (r)^2 h$ where $8.45 \leq r \leq 8.55$ or Volume = $\frac{m}{d}$ where $5075 \leq m \leq 5085$ and $8.725 \leq d \leq 8.735$			M1 Correct method to find Volume. Allow $\pi$ instead of 3.142
	$[h =] \frac{5085}{\frac{1}{3} \times 3.142 \times 8.45^2 \times 8.725}$			M1 dep on previous M being awarded. Correct formula used for the height of cone, using $m_{\text{UB}}$ where $5080 < m_{\text{UB}} \leq 5085$ , $r_{\text{LB}}$ where $8.45 \leq r_{\text{LB}} < 8.5$ , and $d_{\text{LB}}$ where $8.725 \leq d_{\text{LB}} < 8.73$ Allow if use $\pi$ instead of 3.142
		7.8	4	A1 awrt 7.8 from correct working. Must be seen to use 5085, (Allow 5084.99...), 8.45, 8.725
<b>Total 4 marks</b>				



Question	Working	Answer	Mark	Notes
21	$\left(\sqrt{\frac{10478}{1550}}\right)^3 \left[ = \frac{2197}{125} \right] \text{ oe}$			M2 The correct scale factor (17.576) Allow (M1) for $\left(\frac{10478}{1550}\right)^3$ or $\sqrt{\frac{10478}{1550}} \left[ = \frac{13}{5} \right]$ or $5\sqrt{62}$ <b>and</b> $13\sqrt{62}$ identified as the linear SF (Accept 5 and 13)
	$V_A \times \frac{2197}{125} - V_A = 62160 \text{ oe}$			M1 dep on at least one of the previous M being awarded. For equation with their SF. May be implied.
	$[V_A =] \frac{62160}{\frac{2197}{125} - 1}$			M1 dep on previous M mark being awarded. For making $V_A$ the subject. Allow equivalent methods
		3750		A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working)
			5	
<b>Alternative</b>				
	$\left(\sqrt{\frac{1550}{10478}}\right)^3 \left[ = \frac{125}{2197} \right] \text{ oe}$			M2 The correct scale factor (0.0568957...) Allow (M1) for $\left(\frac{1550}{10478}\right)^3$ or $\sqrt{\frac{1550}{10478}}$ or $5\sqrt{62}$ <b>and</b> $13\sqrt{62}$ identified as the linear SF (Accept 5 and 13)
	$V_B - V_B \times \frac{125}{1297} = 62160 \text{ oe}$			M1 dep on at least one of the previous M being awarded. For equation with their SF. May be implied
	$[V_B =] \frac{62160}{1 - \frac{125}{2197}} - 62160$			M1 dep for making $V_B$ the subject and subtracting 62160. Allow equivalent methods
		3750		A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working)
				<b>Total 5 marks</b>

Question	Working	Answer	Mark	Notes
22	$x + 7x = 180 \Rightarrow x = 22.5$			M1 Correct method to find the value of $x$ or $7x$ Allow if 22.5 or 157.5 seen
	[Sum of angles of $BCDEFGP =$ $180(7 - 2) [= 900]$			M1 Calculating the sum of interior angles of a relevant polygon eg For $GFEDCBA$ $180(6 - 2) [= 720]$ For $GFEDCBAH$ $180(8 - 2) [= 1080]$
	Internal angle eg $BCD$ $180 + "22.5" [= 202.5]$ oe			M1 Correct method to calculate a second relevant angle(sum of angles) eg $360 - "157.5" [= 202.5]$ or for $GFEDCBA$ $720 - 4 \times "157.5" [= 90]$ or for $GFEDCBAH$ $1080 - 6 \times "157.5" [= 135]$
	$[\angle GPB =] "900" - 2 \times "22.5" - 4 \times "202.5"$			M1 Dep on all 3 previous method marks being awarded. Complete correct method to find $\angle BPG$ eg for $PGB$ $180 - 90 - 22.5 \times 2$ or for $PAH$ $180 - 135$
		45	5	A1 Previous method mark must be awarded
				<b>Total 5 marks</b>
<b>Alternative</b> – using kite $BPGO$ or $OAPH$ (where $O$ is the centre of the $n$ -sided polygon)				
	$x + 7x = 180 \Rightarrow x = 22.5$			M1 Correct method to find the value of $x$ or $7x$ Allow if 22.5 or 157.5 seen
	$[n =] \frac{360}{"22.5"} [= 16]$			M1 finding the number of sides of the $n$ -sided polygon
	$OGP = 4.5x$ and $OBP = 4.5x$ $BOG = 5x$ or $OHP = 3.5x$ and $OAP = 3.5x$ $AOH = 7x$			M1 Correct method to find the 3 angles of a kite
	$360 - 14 \times "22.5"$			M1 dep on all 3 previous method marks being awarded. Complete correct method to find $\angle BPG$
		45		A1

Question	Working	Answer	Mark	Notes
23	$2x+16$ and $5x-107$			M1 or $X+16$ and $Y-107$ and $5X=2Y$
	$\frac{2x+16}{4} = \frac{5x-107}{3}$ oe			M1 dep Allow one sign error or $\frac{X+16}{Y-107} = \frac{4}{3}$ or Allow $2x+16=4y$ and $5x-107=3y$
	$[x=]34$			M1 dep on both previous Method marks. Using a correct method to solve equation(s) leading to $x = \dots$ or $y = \dots$ or $5x = \dots$ or $X = \dots$ or $Y = \dots$
	$5 \times "34" - 107$			M1 dep on previous mark. or $3 \times "21"$
		63	5	A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)
				<b>Total 5 marks</b>
<b>Alternative</b>				
	$T$ is the total number of eagles in 2003 $t$ is the total number of eagles in 2015			
	$\frac{2}{7}T+16$ and $\frac{5}{7}T-107$ <b>or</b> $\frac{4}{7}t-16$ and $\frac{3}{7}t+107$			M1 May be seen as part of a correct equation.
	$\frac{2}{7}T+16 = \frac{4}{7}t$ and $\frac{5}{7}T-107 = \frac{3}{7}t$ oe			M1 dep for 2 correct equations
	$t=147$ <b>or</b> $T=238$			M1 dep on both previous Method marks. Using a correct method to solve equation(s) leading to $T = \dots$ or $t = \dots$ or $5T = \dots$ or $3t = \dots$
	$\frac{3}{7} \times "147"$ <b>or</b> $\frac{5}{7} \times "238" - 107$			M1 dep on previous mark. Allow their 147 or their 238
		63		A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working)