

Question		Working		Answer	Mark	Notes
4	(a)			275	1	B1
	(b)		eg ‘it would mean $n^2 = -9$ which is not possible’ <b>or</b> ‘all numbers are greater than 100’ oe	1	B1 a correct reason (which needs to refer to a value other than 37) eg <ul style="list-style-type: none"> <li><math>n^2 = -9</math> <b>or</b> <math>n = \sqrt{-9}</math> or <math>7n^2 = -63</math> <b>and</b> idea this is not possible (eg <math>n^2</math> cannot be negative or <math>n</math> or <math>n^2 \geq 0</math> or needs to be a whole number/positive</li> <li>numbers cannot be less than 100</li> <li>numbers are <math>&gt; 100</math> or <math>\geq 100</math></li> <li>numbers are <math>\geq 107</math> or <math>&gt; 107</math></li> <li>the smallest value is 107</li> <li>the first term is 107 <b>and</b> terms increase /don’t decrease</li> </ul>	
						<b>Total 2 marks</b>

Question		Working		Answer	Mark	Notes
5		6 180 000 000 oe eg $6.18 \times 10^9$ <b>or</b> $61.8 \times 10^8$ <b>or</b> 20 600 000 oe eg $20.6 \times 10^6$ <b>or</b> $2.06 \times 10^n$ where $n \neq 7$ <b>or</b> $2 \times 10^7 + 0.6 \times 10^6$ or $2 \times 10^7 + 6 \times 10^5$ <b>oe</b>			2	M1 allow for a correct numerator in any form or for a correct answer in any form or for $2.06 \times 10^n$ where $n$ is an integer $\neq 7$ or  for a correct sum with the fraction removed
				$2.06 \times 10^7$		A1 Do not ISW mark their answer on the answer line or if no answer on the answer line their final answer.
		cas				<b>Total 2 marks</b>

Question	Working	Answer	Mark	Notes
6	$6a^4c$ or $46656a^{24}c^6$ or $36^3a^{24}c^6$ or $6^6a^{24}c^6$		2	M1 for correctly applying the power of 3 or the power of a 0.5 to all 3 terms or for an expression of 3 terms in the form $ma^pc^q$ with 2 of $m$ , $p$ and $q$ correct or $a^{12}c^3$
		$216a^{12}c^3$		A1 ISW Do not allow $6^3a^{12}c^3$
	<i>cas</i>			<b>Total 2 marks</b>

Question	Working	Answer	Mark	Notes
7	$\frac{9}{4}[\div]\frac{15}{7}$ oe		3	M1 for writing both mixed numbers as improper fractions. Do not need the division sign. Implied by the 2 <sup>nd</sup> M1
	eg $\frac{9}{4} \times \frac{7}{15}$ oe eg $\frac{135}{60} \times \frac{28}{60}$ oe			M1 for inverting the 2 <sup>nd</sup> fraction and showing multiplying or for writing the improper fractions over a common denominator
		$\frac{63}{60} = 1\frac{1}{20}$ or $\frac{21}{20} = 1\frac{1}{20}$		A1 dependent on both Method marks being awarded. For completion to the correct answer with full working shown. We need to see the improper fraction followed by the mixed number
	<i>wr</i>			<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes
8	$3 \times 12x^2$ or $36x^2$		3	M1 for differentiating the first term correctly
	$\left[\frac{16}{x^2} = \right] 16x^{-2}$			M1 for rewriting the second term as $16x^{-2}$ This can be seen anywhere including in an expression for dy/dx May be implied by $-2 \times 16x^{-3}$ oe
		$36x^2 - 32x^{-3}$		A1 oe eg $36x^2 - \frac{32}{x^3}$ Need not be simplified eg allow $3 \times 12x^2 - 2 \times 16 \times x^{-3}$
	<i>cas</i>			<b>Total 3 marks</b>

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

9		39.5, 40.5, 2.15, 2.25, 0.55, 0.65		3	M1 one correct bound allow $40.4\dot{9}$ for 40.5, $2.24\dot{9}$ for 2.25, $0.64\dot{9}$ for 0.65
		$\frac{UB_a}{LB_c - UB_f}$ where $(40 < UB_a \leq 40.5)$ $(2.15 \leq LB_c < 2.2) - (0.6 < UB_f \leq 0.65)$			M1 where $40 < UB_a \leq 40.5$ and $2.15 \leq LB_c < 2.2$ and $0.6 < UB_f \leq 0.65$
			$\frac{40.5}{2.15 - 0.65} = 27$		A1 for 26.97 to 27 if all correct figures seen in the equation. Allow $40.4\dot{9}$ for 40.5 and $0.64\dot{9}$ for 0.65
		wr			Total 3 marks

Question	Working	Answer	Mark	Notes
10		$y \geq -1$	4	B1 oe accept $>$ for $\geq$
		$x + 2y \leq 8$		B1 oe eg $y \leq 4 - \frac{x}{2}$ accept $<$ for $\leq$
	eg $y = 2x + 3$ or $y - 2x = 3$ or $y - (1) = 2(x - (-1))$ oe			M1 for the correct equation for the line written in any form. eg with any sign ( $= > < \geq \leq$ )
		$y \leq 2x + 3$		A1 oe allow equivalent inequality eg $y - 2x \leq 3$ or $y - (1) \leq 2(x - (-1))$ accept $<$ for $\leq$
		SC if $y \leq -1$ and $x + 2y \geq 8$ and $y \geq 2x + 3$ score B2. Allow correct sign without the =		
	cas			Total 4 marks

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

11	(a)		a circle centre $A$ with radius 4 cm	1	B1 full circle. Radius 4cm (allow if closer to $Y$ than to $B$ )
	(b)		a correct bisector with arcs shown	2	B2 for a correct bisector with 2 pairs of arcs Allow if it is only one side of the line $AB$ (use overlay) (NB may use the circle as one of the pair of arcs) (B1 for a bisector without the arcs or only one pair drawn or correct arcs without bisector drawn (must cross with in the lines on overlay or would if they were extended))
	(c)		correct region indicated	1	B1 dep on at least B1 being awarded in (b) for the bisector drawn. For the correct region between the bisector and the circle identified. Allow if a partial circle around $A$ is drawn which intersects with their bisector twice and at least B1 awarded for the bisector drawn. NB if they do not shade and just label $R$ they need to put $R$ both sides of the line $AB$ (if they have drawn the line $AB$ )
					<b>Total 4 marks</b>

Q	Working	Answer	Mark	Notes
12	eg $x^2 + x^2 = 12.6^2$ or $[AC^2 =](0.5 \times 12.6)^2 + (0.5 \times 12.6)^2 [= 39.69 + 39.69^2 = 79.38]$ or eg $\sin 45 = \frac{AC}{12.6}$ or $\cos 45 = \frac{AC}{12.6}$ or $\cos 45 = \frac{6.3}{AC}$ or $\sin 45 = \frac{6.3}{AC}$ oe		4	M1 for a correct statement using Pythagoras or trigonometry to find side $AB/AC$ NB do not award for $AB^2 + AC^2 = 12.6^2$ unless made clear $AB = AC$ . Allow $AB$ instead of $AC$ May be Implied by the 2 <sup>nd</sup> M1
	$[x =] \sqrt{\frac{12.6^2}{2}} = \left[ \sqrt{\frac{3969}{25}} = 8.909\dots \right]$ or $[AC =] \sqrt{(0.5 \times 12.6)^2 + (0.5 \times 12.6)^2} [= 8.9090\dots]$ or $[AB/AC =] 12.6 \times \sin 45$ or $12.6 \times \cos 45$ $[AC/AB =] \frac{6.3}{\cos 45}$ or $\frac{6.3}{\sin 45}$			M1 dependent on 1st M1 for a correct method to find $AB$ or $AC$ Allow for 8.9 or better (actual 8.909545...) or $\frac{63\sqrt{2}}{10}$ Allow 9 if $x^2 = 79.3\dots$ is seen
	$2 \times "8.909\dots" + 12.6$			M1 independent of the previous method marks. Allow $\frac{63 + 63\sqrt{2}}{5}$ For using $2 \times n + 12.6$ where $6.3 < n < 12.6$ If $n$ is incorrect, working must be shown
		30.4		A1 awrt 30.4 (actual 30.41909...)
	<i>cas</i>			<b>Total 4 marks</b>

Qu	Working	Ans	Mar	Notes
----	---------	-----	-----	-------

13	$[QR = ] \frac{8}{\tan 40}$ <b>or</b> $\tan 40 = \frac{8}{QR}$ <b>or</b> $\tan 50 = \frac{QR}{8}$ <b>or</b> $\frac{QR}{\sin 50} = \frac{8}{\sin 40}$ <b>oe</b> $[PR = ] \frac{8}{\sin 40}$ <b>or</b> $\frac{8}{\cos 50}$ (= 12.445...) <b>or</b> $\sin 40 = \frac{8}{PR}$ <b>or</b> $\cos 50 = \frac{8}{PR}$ <b>oe</b>	4	M1 for a correct method or expression to find <i>QR</i> <b>or</b> <i>PR</i> . Allow any letter(s) for <i>QR/PR</i> or mislabelling or equivalents eg $[QR = ] 8 \tan 50 (= 9.534...)$ If no working shown allow for awrt 12 or awrt 10
	eg $[QR = ] \frac{8}{\tan 40}$ (= 9.534...) <b>AND</b> $[PR = ] \frac{8}{\sin 40}$ <b>or</b> $\frac{8}{\cos 40}$ (= 12.445...) <b>oe or</b> $[QR = ] \frac{8}{\tan 40}$ (= 9.534...) <b>AND</b> $[PR = ] \sqrt{8^2 + "9.534..."^2}$ (= 12.445...) <b>oe or</b> $[PR = ] \frac{8}{\sin 40}$ (= 12.445...) <b>AND</b> $[QR = ] \sqrt{"12.445..."^2 - 8^2}$ (= 9.534...) <b>oe or</b> area of <i>PTR</i> = $0.5 \times \pi \times \left(\frac{"12.445..."}{2}\right)^2$ [= 60.8...] <b>or</b> area of <i>PQR</i> = $\frac{1}{2} \times 8 \times "9.534..."$ <b>or</b> $\frac{1}{2} \times 8 \times "12.445..." \times \sin(90 - 40)$ <b>or</b> $\frac{1}{2} \times "12.445..." \times "9.534..." \sin 40$ [= 38.1...]		M1 dependent on first M1 being awarded for a correct method or expression to find <i>QR</i> <b>AND</b> <i>PR</i> or 0.5 <i>PR</i> . Allow equivalent expressions eg those allowed for the 1st M1 <b>NB</b> $\frac{PR}{\sin 90} = \frac{QR}{\sin 50} = \frac{8}{\sin 40}$ <b>oe</b> gains M1M1 <b>or</b> for a correct method to find the area of the semicircle <i>PTR</i> or a correct method to find area of <i>PQR</i> using their <i>PR</i> (from correct working) and <i>PQ</i> = 8 Allow numbers written to 1 dp. When finding the areas "12.445" or "9.534" must come from correct working.
	$0.5 \times "9.534..." \times 8 + 0.5 \times \pi \times \left(\frac{"12.445..."}{2}\right)^2$ <b>or</b> $0.5 \times 8 \times "12.445..." \sin(50) + 0.5 \times \pi \times \left(\frac{"12.445..."}{2}\right)^2$ <b>or</b> $0.5 \times "12.445..." \times "9.534..." \sin(40) + 0.5 \times \pi \times \left(\frac{"12.445..."}{2}\right)^2$		M1 correct method to find the whole area. If working is shown ft their <i>PR</i> (diameter) and/or <i>PQ</i> if clearly labelled or marked on the diagram or comes from correct working. Allow $\frac{"12.445..."}{2}$ or "6.22..." for the radius.
		99	A1 awrt 99 or awrt 98
	<i>cas</i>		<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

14		eg $6x + 18y = 42$ or $10x + 30y = 70$ <u><math>6x + 10y = 20</math></u> <u><math>18x + 30y = 60</math></u>  or  eg $3\left(\frac{14-6y}{2}\right) + 5y = 10$ or $3x + 5\left(\frac{14-2x}{6}\right) = 10$		4	M1 For balancing the equations (only condone one arithmetic error in multiplication). <b>and</b> correct operation to eliminate selected variable applied to all terms in their 2 equations)  <b>or</b> writing $x$ or $y$ in terms of the other variable and correctly substituting to gain an equation in one variable
			$x = -1.25$ or $y = 2.75$		A1 oe one correct value dep on M1 Allow fractions eg $-\frac{7}{4}$ and $\frac{11}{4}$
		eg $2 \times "-1.25" + 6y = 14$ oe or $3x + 5 \times "2.75" = 10$ oe			M1 (dep) correct method to find second variable – could start process again or use substitution. Dependent on previous M mark being awarded. If the value used is incorrect you may need to check their answer if full working not shown.
			$x = -1.25$ and $y = 2.75$		A1 oe for both correct values dep on at least one of the method marks being awarded. If switched on the answer line allow if seen correct in working
		wr			<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

15		$c^2 = \frac{3y+5}{8-y}$ oe or $c\sqrt{8-y} = \sqrt{3y+5}$		4	M1 for either squaring both sides to remove the square root or removing the denominator of the expression.
		$8c^2 - c^2y = 3y+5$ or $8-y = \frac{3y}{c^2} + \frac{5}{c^2}$ or $8-y = \frac{3y+5}{c^2}$ oe			M1 dependent on 1 <sup>st</sup> M1 being awarded. For squaring both sides to remove the square root and removing the terms in y from the denominator of the expression and expanding to gain a correct equation. Implies the previous M1
		$8c^2 - 5 = 3y + c^2y$ oe or $-c^2y - 3y = -8c^2 + 5$ oe or $c^2y + 3y = 8c^2 - 5$ oe or $y(-c^2 - 3) = -8c^2 + 5$ oe or $-\frac{3y}{c^2} - y = \frac{5}{c^2} - 8$ oe			M1 for collecting the y terms on one side of the equation with the other terms on the other side. Allow one sign error  If the 2 <sup>nd</sup> M1 has not been awarded then ft their equation providing the equation has 4 distinct terms with exactly 2 in terms of y. Allow one sign error
			$y = \frac{8c^2 - 5}{3 + c^2}$		A1 oe eg $y = \frac{5-8c^2}{-c^2-3}$ or $y = \frac{8-\frac{5}{c^2}}{\frac{3}{c^2}+1}$ oe  (NB: if the final answer is missing $y = \dots$ but is otherwise correct, award full marks if $y =$ a correct expression has been seen in the working otherwise do not ISW)
		<i>cas</i>			<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

16		eg $8 \times 4.5 = 3CP$ or $\frac{8}{3} = \frac{CP}{4.5}$ or $\frac{8}{3} = \frac{x + (x+3)}{4.5}$ $\frac{8}{3} = \frac{r + (r-3)}{4.5}$ oe		4	M1 for forming a correct equation. Using the chord theorem.
		$[CP =] \frac{8 \times 4.5}{3} [= 12]$ or $r = \frac{8 \times 4.5 + 3}{3 \times 2} [= 7.5]$ or $x = \frac{8 \times 4.5 - 3}{3 \times 2} [= 4.5]$			M1 for a correct expression for $CP$ May be seen on diagram
		[circumference = ] $\pi \times ("12" + 3)$ oe $2 \times \pi \times "7.5"$ or $2\pi \times ("4.5" + 3)$			M1 ft their $CP$ if it comes from correct working or is clearly labelled or on the diagram. Allow 3.14... or $\frac{22}{7}$ for $\pi$
			47.1		A1 awrt 47.1 or $15\pi$
		cas			Total 4 marks

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------

17	(a)	$\left[ \begin{smallmatrix} \vec{OB} \end{smallmatrix} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} 5 \\ -9 \end{pmatrix} \text{ or } \begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} -5 \\ 9 \end{pmatrix} \text{ or}$		2	M1 for a correct method to find $\vec{OB}$ or may be implied by one correct value ie $\begin{pmatrix} -2 \\ \dots \end{pmatrix}$ or $\begin{pmatrix} \dots \\ 7 \end{pmatrix}$ or for $\begin{pmatrix} 7 \\ -2 \end{pmatrix}$ Must be seen on (a)
			$\begin{pmatrix} -2 \\ 7 \end{pmatrix}$		A1
	(b)	$\sqrt{(-2)^2 + 7^2} [= 7.28\dots] \text{ oe}$		2	M1 allow use of 2 rather than -2 and -7 rather than 7. May be implied by a correct answer or awrt 7.28 Condone missing brackets around negative values.  Only ft their values from (a) or $\vec{OB}$ found in (b) if working shown (allow $\pm$ their values)
			$\sqrt{53}$		A1 ft their answer (as a simplified surd) to (a) or $\vec{OB}$ found in (b) Do not ISW. This mark implies the M1 If no working is shown you may need to check.
		<i>cas</i>			<b>Total 4 marks</b>

Question	Working	Answer	Mark	Notes
----------	---------	--------	------	-------