Question		Working	Answer	Mark	Notes
1		$\frac{75}{3000}$ or $\frac{0.075}{3}$ or $\frac{7.5}{300}$ or $\frac{0.75}{30}$ oe		2	M1 a 'correct' but un-simplified fraction (condone decimals in the fraction) eg $\frac{75\times10^{-3}}{3}$ or an answer of 0.025 or 2.5% or 2.5×10^{-2} oe eg 25×10^{-3}
			$\frac{1}{40}$		A1cao Do not ISW ignore any units eg $\frac{1mm}{40mm}$
		cas			**Total 2 marks**

Question		Working	Answer	Mark	Notes
2	(a)		5.143	1	B1
	(b)		6280	1	B1 allow 628×10 or 628×10^{1} or 6.28×10^{3} or 6.280×10^{3} or 62.8×10^{2} 62.80×10^{2} Do not accept 6.2800×10^{3}
					Total 2 marks

Question		Working	Answer	Mark	Notes
3			$4t^5v^2$	2	B2 (B1 for an expression in which 2 of the terms have been simplified correctly. eg $4t^5$ or $4t^5v$)
		cas			**Total 2 marks**

Question		Working	Answer	Mark	Notes
4	(a)		275	1	B1
	(b)	eg 'it would mean $n^2 = -9$ which is not possible' **or** ' all numbers are greater than 100' oe		1	B1 a correct reason (which needs to refer to a value other than 37) eg • $n^2 = -9$ **or** $n = \sqrt{-9}$ or $7n^2 = -63$ **and** idea this is not possible (eg n^2 cannot be negative or n or $n^2 \geqslant 0$ or needs to be a whole number/positive • numbers cannot be less than 100 • numbers are > 100 or $\geqslant 100$ • numbers are $\geqslant 107$ or > 107 • the smallest value is 107 • the first term is 107 **and** terms increase /don't decrease
					Total 2 marks

Question		Working	Answer	Mark	Notes
5		6 180 000 000 oe eg 6.18×10^9 **or** 61.8×10^8 **or** 20 600 000 oe eg 20.6×10^6 **or** 2.06×10^n where $n \neq 7$ **or** $2\times10^7 + 0.6\times10^6$ or $2\times10^7 + 6\times10^5$ **oe**		2	M1 allow for a correct numerator in any form or for a correct answer in any form or for 2.06×10^n where n is an integer $\neq 7$ or for a correct sum with the fraction removed
			2.06×10^7		A1 Do not ISW mark their answer on the answer line or if no answer on the answer line their final answer.
		cas			**Total 2 marks**

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 $6^3a^{12}c^3$
		cas			**Total 2 marks**

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 2nd M1
		eg $\frac{9}{4}\times\frac{7}{15}$ oe eg $\frac{135}{60}\times\frac{28}{60}$ oe			M1 for inverting the 2nd 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
		wr			**Total 3 marks**

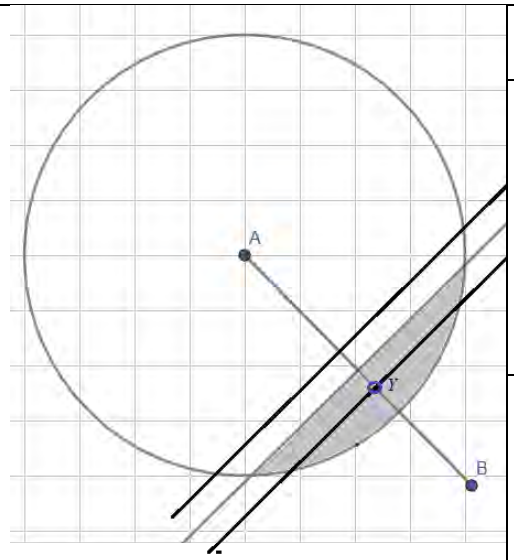
Question		Working	Answer	Mark	Notes
8		$3\times12x^2$ or $36x^2$		3	M1 for differentiating the first term correctly
		$\left[\frac{16}{x^2}=\right]16x^{-2}$			M1 for rewriting the second term as $16x^{-2}$ This can be seen anywhere including in an expression for dy/dx May be implied by $-2\times16x^{-3}$ oe
			$36x^2-32x^{-3}$		A1 oe eg $36x^2-\frac{32}{x^3}$ Need not be simplified eg allow $3\times12x^2-2\times16\times x^{-3}$
		cas			**Total 3 marks**

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 $\frac{(40 < UB_a \leqslant 40.5)}{(2.15 \leqslant LB_c < 2.2) - (0.6 < UB_f \leqslant 0.65)}$			M1 where $40 < UB_a \leqslant 40.5$ and $2.15 \leqslant LB_c < 2.2$ and $0.6 < UB_f \leqslant 0.65$
			$\frac{40.5}{2.15 - 0.65} = 27$		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			$y \geqslant -1$	4	B1 oe accept > for $\geqslant$
			$x + 2y \leqslant 8$		B1 oe eg $y \leqslant 4 - \frac{x}{2}$ accept < for $\leqslant$
		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 ($= > < \geqslant \leqslant$)
			$y \leqslant 2x + 3$		A1 oe allow equivalent inequality eg $y - 2x \leqslant 3$ or $y - (1) \leqslant 2(x - (-1))$ accept < for $\leqslant$
		SC if $y \leqslant -1$ and $x + 2y \geqslant 8$ and $y \geqslant 2x + 3$ 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*)
					Total 4 marks

Q	Working	Answer	Mark	Notes
12	eg $x^2 + x^2 = 12.6^2$ or $\left[AC^2 =\right](0.5\times12.6)^2 + (0.5\times12.6)^2 \left[= 39.69 + 39.69^2 = 79.38\right]$ 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 2nd M1
	$\left[x =\right]\sqrt{\frac{12.6^2}{2}} = \left[\sqrt{\frac{3969}{25}} = 8.909\ldots\right]$ or $\left[AC =\right]\sqrt{(0.5\times12.6)^2 + (0.5\times12.6)^2}$ [= 8.9090…] or $\left[AB / AC =\right]12.6\times\sin 45$ or $12.6\times\cos 45$ $\left[AC / AB =\right]\frac{6.3}{\cos 45}$ 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 $x^2 = 79.3...$ is seen
	$2\times$"8.909…"$+12.6$			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…)
	cas			**Total 4 marks**

Qu	Working	Ans	Mar	Notes

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

Question	Working	Answer	Mark	Notes

14		eg $6x + 18y = 42$ or $10x + 30y = 70$ $6x + 10y = 20$ $18x + 30y = 60$ 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). **and** correct operation to eliminate selected variable applied to all terms in their 2 equations) **or** 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			**Total 4 marks**

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 1st 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 2nd 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* =…but is otherwise correct , award full marks if *y* = a correct expression has been seen in the working otherwise do not ISW)
		cas			**Total 4 marks**

Question	Working	Answer	Mark	Notes

16		eg $8\times4.5=3CP$ 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.
		$[CP=]\frac{8\times4.5}{3}[=12]$ or $r=\frac{8\times4.5+3}{3\times2}[=7.5]$ or $x=\frac{8\times4.5-3}{3\times2}[=4.5]$			M1 for a correct expression for *CP* May be seen on diagram
		[circumference =] $\pi\times(\text{"12"}+3)$ oe $2\times\pi\times\text{"7.5"}$ or $2\pi\times(\text{"4.5"}+3)$			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 π
			47.1		A1 awrt 47.1 or 15π
		cas			**Total 4 marks**

Question	Working	Answer	Mark	Notes

17	(a)	$\left[\overrightarrow{OB} =\right]\begin{pmatrix}3\\-2\end{pmatrix}-\begin{pmatrix}5\\-9\end{pmatrix}$ or $\begin{pmatrix}3\\-2\end{pmatrix}+\begin{pmatrix}-5\\9\end{pmatrix}$ or		2	M1 for a correct method to find $\overrightarrow{OB}$ or may be implied by one correct value ie $\begin{pmatrix}-2\\...\end{pmatrix}$ or $\begin{pmatrix}...\\7\end{pmatrix}$ or for $\begin{pmatrix}7\\-2\end{pmatrix}$ Must be seen on (a)
			$\begin{pmatrix}-2\\7\end{pmatrix}$		A1
	(b)	$\sqrt{("-2")^2+"7"^2}\ [=7.28...]$ 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 $\overrightarrow{OB}$ found in (b) if working shown (allow $\pm$ their values)
			$\sqrt{53}$		A1 ft their answer (as a simplified surd) to (a) or $\overrightarrow{OB}$ found in (b) Do not ISW. This mark implies the M1 If no working is shown you may need to check.
		cas			**Total 4 marks**

Question	Working	Answer	Mark	Notes

18	(a)		$30 < h \leqslant 40$	1	B1 condone $\leqslant$ for $<$ and vice versa
	(b)	$5 \times 2 + 15 \times 26 + 25 \times 10 + 35 \times 24 + 45 \times 18$ (= 2300) $10 + 390 + 250 + 840 + 810$ (= 2300)		4	M2 for at least 3 correct products using midpoints with intention to add. (M1 for at least 3 products using frequency and a value within the interval with the intention to add. (allow use of upper/lower class bound) **or** for at least 3 correct products using midpoints without adding)
		$\frac{"10 + 390 + 250 + 840 + 810"}{80}\left[=\frac{"2300"}{80}\right]$			M1 dep on at least M1 being awarded
			28.75		A1oe allow $\frac{115}{4}$ or 28.7 or 28.8 or (29 from correct working)
		cas			**Total 5 marks**

Question		Working	Answer	Mark	Notes
19		$2x+3+5x-12+3x+1=32$ oe eg $10x-8=32$		5	M1 for setting up an equation. Implied by $x = 4$
		$x=\frac{32+8}{10}\left[=4\right]$ oe or 7**T** vanilla = 13 oe			M1 rearranging to find a correct expression for x or for 7T vanilla
		$\frac{80}{360}\times 45\ (=10)$ oe			M1 Correct method to find the number for vanilla for **8Y eg** $45-\frac{280}{360}\times 45$
		$3\times"4"+1-"10"$ or			M1 dependent on the 1st and 3rd M1 being awarded. Allow an answer of 3 or a correct method to find their difference. Ft their value of x and 10 if clearly labelled or come from correct working.
			3		A1 dependent on 1st and 3rd method mark being awarded. **NB** the number 3 can be gained from incorrect working, so need to check it. If no working is shown then award 5/5
					Total 5 marks

Question	Working	Answer	Mark	Notes

20	(a)	$7+3y=2(4y-7-5)$ oe or $7+3y+2\times5=2(4y-7)$ oe or $\frac{7}{2}+\frac{3}{2}y+5=4y-7$ oe		3	M1 for dealing with the fraction (of 0.5) correctly. Condone missing brackets if they have recovered.
		$3y-8y=-14-10-7$ oe eg $5y=31$ or $\frac{7}{2}+5+7=4y-\frac{3}{2}y$ oe			M1ft previous stage as long as at least 4 terms to deal with – for collecting terms in y on one side and number terms the other side
		wr	6.2		A1 dep on both the previous 2 Marks being awarded oe eg $\frac{31}{5}$
	(b)	$-35=8x-2\times-4.5$ oe or $x=\frac{A+2w}{8}$		2	M1 for a correct substitution into the given formula or for a correct rearrangement of the formula to make x the subject
		cas	–5.5		A1 oe eg $\frac{-44}{8}$ or $\frac{-11}{2}$
					Total 5 marks

Que	Working	Ans	M	Notes

21	eg $\{2\pi r^2$ **and** $2\pi(3r)^2\}$ **or** $\left\{2\pi\left(\frac{R}{3}\right)^2 \text{ and } 2\pi R^2\right\}$ **or** $2R^2+R^2+2r^2-r^2$ **or** $2\pi R^2+\pi R^2+2\pi r^2-\pi r^2$ **or** $2(3)^2+(3)^2+2(1)^2-(1)^2$ **or** $2\pi(3)^2+\pi(3)^2+2\pi(1)^2-\pi(1)^2$ oe		5	M1 surface areas of both hemispheres seen (need not be added and may be part of an equation) Or for a correct formula for the total surface area. Allow $\{2\pi(nr)^2$ **and** $2\pi(mr)^2\}$ or $2(m)^2+m^2+2(n)^2-(n)^2$ or $2\pi(m)^2+\pi m^2+2\pi(n)^2-\pi(n)^2$ where $m=3n$ Allow use of other letters May be implied by the 2nd M1
	$2\pi r^2+2\pi(3r)^2+\pi(3r)^2-\pi r^2=567\pi$ oe or $2\pi R^2+2\pi\left(\frac{R}{3}\right)^2+\pi R^2-\pi\left(\frac{R}{3}\right)^2=567\pi$ oe or $2(3)^2+(3)^2+2(1)^2-(1)^2:567$ $2\pi(3)^2+\pi(3)^2+2\pi(1)^2-\pi(1)^2:567\pi$			M1 a correct equation for the surface area of the solid eg $2(nr)^2+2(3nr)^2+(3nr)^2-(nr)^2=567$ or $28\pi r^2=567\pi$ or $28r^2=567$ or $2R^2+2\left(\frac{R}{3}\right)^2+R^2-\left(\frac{R}{3}\right)^2=567$ Allow $2x^2+2(y)^2+(y)^2-x^2=567$ $2(y)^2+(y)^2+2(x)^2-(x)^2:567$ where $y=3x$ This implies the 1st M1
	$[r=]$ 4.5 **or** $[R=]$ 13.5			M1 for a correct value of the radius for either hemisphere. This implies the 2nd M1
	$\frac{1}{2}\times\frac{4}{3}\pi\times"4.5"^3+\frac{1}{2}\times\frac{4}{3}\pi\times"13.5"^3 \left[=\frac{243}{4}\pi+\frac{6561}{4}\pi\right]$			M1 a fully correct method to find the volume of the solid dep on at least one of the previous Method marks being awarded and is equivalent to $\frac{1}{2}\times\frac{4}{3}\pi\times"m"^3+\frac{1}{2}\times\frac{4}{3}\pi\times"3m"^3$ where m is a number (award 4 marks for 1701π)
	wr	5340		A1 awrt to 5340 dependent on at least the 3rd M1 mark being awarded from correct working (5343.8….)
				Total 5 marks

Question		Working	Answer	Mark	Notes
22	(a)	$5\sqrt{2}+11\sqrt{2}$ [$=16\sqrt{2}$] or $\sqrt{50+242+2\sqrt{50\times242}}=\left[\sqrt{512}\right]$		2	M1 writing $\sqrt{50}$ and $\sqrt{242}$ in the form $c\sqrt{2}$ and adding or for $16\sqrt{2}$ or for using $\sqrt{\left(\sqrt{50}+\sqrt{242}\right)^2}$ and multiplying out or $\sqrt{512}$
		cas	$8\sqrt{8}$		A1cao allow $a = 8$
	(b)	$\frac{12}{\sqrt{5}-1}\times\frac{\sqrt{5}+1}{\sqrt{5}+1}$ or $\frac{12}{\sqrt{5}-1}\times\frac{-\sqrt{5}-1}{-\sqrt{5}-1}$		3	M1 multiply numerator and denominator by $\sqrt{5}+1$ or $-\sqrt{5}-1$
		$\frac{12\left(\sqrt{5}+1\right)}{5-1}$ or $\frac{12\left(\sqrt{5}+1\right)}{4}$ or $\frac{12\sqrt{5}+12}{5-1}$ or $\frac{12\sqrt{5}+12}{4}$ or $\frac{12\left(-\sqrt{5}-1\right)}{-5+1}$ or $\frac{12\left(-\sqrt{5}-1\right)}{-4}$ or $\frac{-12\sqrt{5}-12}{-5+1}$ or $\frac{-12\sqrt{5}-12}{-4}$			M1 dep on previous M mark being awarded. denominator may be 4 terms which need to all be correct eg. $\frac{12\left(\sqrt{5}+1\right)}{5+\sqrt{5}-\sqrt{5}-1}$
		wr	$3\sqrt{5}+3$		A1 dep on both the previous marks being awarded. Allow $y = 3$ and $x = 5$ or $3+3\sqrt{5}$ do not allow $3\left(\sqrt{5}+1\right)$ and do not ISW
					Total 5 marks

Question	Working	Answer	Mark	Notes

23	(a)	$6\times(-4)^3+k\times(-4)^2-26\times-4-24=0$ or $6\times(-4)^3+19\times(-4)^2-26\times-4-24$		2	M1 correct substitution of $x = -4$ into equation. Must be equal to zero (or implied by later working) or if substituting $x = -4$ and $k = 19$ into the expression we do not need it = 0 for this mark. Condone missing brackets around the –4
		$16k=304$ or $k=\frac{304}{16}$ and $k=19$ or $-384+304+104-24=0$ and shown			A1 completion to show clearly that $k = 19$ either by completing equation correctly (must see at least one line of working after the first line) and $k = 19$ or for $-384+304+104-24=0$ and comment (eg shown, or #)
	(b)	$(6x^2.....)$		4	M1 for a start to find the quadratic factor.
		$(6x^2-5x-6)$			M1 for a correct 3 term quadratic
		$(3x+2)(2x-3)$ or $(3x+2)(2x-3)(x+4)$			M1 dependent on the 2nd M1 being awarded for correct factorisation of the quadratic. Do not allow fractions or decimals eg $(x-1.5)$ or $\left(x+\frac{2}{3}\right)$ (ie) **or** a correct use of the quadratic formula. Implied by $-\frac{2}{3}$ and $\frac{3}{2}$ as two of the solutions (Allow –0.67 or better for $-\frac{2}{3}$)
			–4, $-\frac{2}{3}$, $\frac{3}{2}$		A1 oe (–0.67 or better for $-\frac{2}{3}$) dep on all 3 method marks being awarded. Do not ISW. Mark the answer on the answer line. If no answer on the answer line mark the final line of their working.
		wr			**Total 6 marks**

Question	Working	Answer	Mark	Notes

24	eg $\frac{0.5N+12.5}{N}$ or $\frac{N+25}{2N}$ or $\frac{p}{2p-25}$ or $\frac{25+y}{2y+25}$ oe		6	M1 for the probability that the first sweet is pink (N = number of sweets, p = number of pink sweets, y = number of yellow sweets) It must be seen as an expression in one letter and may be see in an equation
	eg $\frac{0.5N+12.5}{N}\times\frac{0.5N+11.5}{N-1}=\frac{7}{19}$ or $\frac{N+25}{2N}\times\frac{N+23}{2N-2}=\frac{7}{19}$ or $\frac{p}{2p-25}\times\frac{p-1}{2p-26}=\frac{7}{19}$ or $\frac{y+25}{2y+25}\times\frac{y+24}{2y+24}=\frac{7}{19}$ oe			M1 for a correct equation for 2 pink sweets. Must be expressed using one variable. This mark implies the 1st M1
	eg $2.25N^2 - 235N - 2731.25 = 0$ or $9N^2 - 940N - 10925 = 0$ or $9p^2 - 695p + 4550 = 0$ or $9y^2 - 245y - 7200 = 0$			M1 a correct 3 term quadratic for N or p or y (allow any letter) condone missing =0
	eg $(9N + 95)(N - 115)$ or $(9p-65)(p-70)$ or $(9y + 160)(y - 45)$ oe			M1 dep on 2nd M1 for a correct method to solve their 3 term quadratic – if factorising allow brackets that multiply giving 2 correct terms, if formula used then allow one error. Working must be shown if the equation is incorrect. Seeing or using $N = 115$ or $p = 70$ or $y = 45$ implies the 3rd and 4th Method marks
	$\frac{45}{115}\times\frac{44}{114}$			M1 for a correct calculation for the probability of 2 yellow sweets May be implied by a correct answer
	wr	$\frac{66}{437}$		A1 oe eg 0.151(029…) The correct answer will gain full marks if at least 2 method marks have been awarded.
	PTO for SC			

	SC for yellow is 25 more than pink M0M1M1M1M0A0			
	$\frac{0.5N-12.5}{N}\times\frac{0.5N-13.5}{N-1}=\frac{7}{19}$ or $\frac{N-25}{2N}\times\frac{N-27}{2N-2}=\frac{7}{19}$ or $\frac{y-25}{2y-25}\times\frac{y-26}{2y-26}=\frac{7}{19}$ or $\frac{p}{2p+25}\times\frac{p-1}{2p+24}=\frac{7}{19}$			M1 for a correct equation for 2 pink sweets. Must be expressed using one variable.
	$2.25N^2+240N-3206.25=0$ or $9N^2+960N-12825=0$ $9y^2+255y-7800=0$ $9p^2+705p+4200=0$			M1 a correct quadratic for N, p or y condone missing =0
	$[N=]\frac{240\pm\sqrt{(240)^2+4\times2.25\times3206.25}}{2\times2.25}$ or $[N=]\frac{-960\pm\sqrt{960^2+4\times900\times12825}}{2\times9}$ or $[y=]\frac{255\pm\sqrt{255^2+4\times9\times7800}}{2\times9}$ $[p=]\frac{-705\pm\sqrt{705^2-4\times9\times4200}}{2\times9}$ or			M1 dep on 2nd M1 for a correct method to solve their 3 term quadratic – if factorising allow brackets that multiply giving 2 correct terms, if formula used then allow one error. Working must be shown
	wr			**Total 6 marks**

Quest	Working	Ans	Mark	Notes
25	$0.5\times8\times11\times\sin115\,(=39.877...)$		5	M1 for a correct method to find the area of triangle *ABC*
	$AC^2=11^2+8^2-2\times11\times8\cos115\,(=259.38...)$ or $AC=\sqrt{11^2+8^2-2\times11\times8\cos115}\,(=16.105...)$			M1 for a correct method to find the length of AC^2 or *AC*
	$\angle CAD=\sin^{-1}\left(\dfrac{\sin(53)\times15}{"16.105..."}\right)[=48.059...]$ **AND** $\angle ACD=180-"48.059"-53\,(=78.94...)$ or $16.105...^2=AD^2+15^2-2\times AD\times15\cos53$ or $AD^2=16.105...^2+15^2-2\times16.105...\times15\cos"78.9..."$ $\left\{\sqrt{"16.105..."^2-11.979\ldots^2}\ \textbf{or}\ "16.105..."\cos\left[\sin^{-1}\left(\dfrac{\sin(53)\times15}{"16.105..."}\right)\right][=10.76...]\right\}$ **AND** $\left\{\sqrt{15^2-11.979\ldots^2}\ \textbf{or}\ 15\cos53[=9.027...]\right\}$			M1 for a correct method to find the angle *ACD* or Finding AD^2 NB $2\times15\cos53=18.054\ldots$ the length *AD* (19.79…) For splitting triangle *ACD* into 2 triangles with perpendicular *CE* where *E* is on *AD* and finding the lengths *AE* (10.76…) and *ED* (9.027…)
	$\frac{1}{2}\times15\times"16.105..."\sin("78.94...")+"39.877.."$ or $\frac{1}{2}\times"19.79..."\times15\sin(53)+"39.877.."$ or $\frac{1}{2}\times"16.105..."\times"19.79..."\left(\dfrac{\sin(53)\times15}{"16.105..."}\right)+"39.877.."$ or $\frac{1}{2}\times15\sin53\times"10.76..."+\frac{1}{2}\times15\sin53\times"9.027..."+"39.877..."$			M1 dependent on all 3 M marks being awarded. For a fully correct method to find the area NB 15 sin 53 = 11.979…
		158.42		A1 for awrt 158 (allow 159)
	cas			**Total 5 marks**

Question	Working	Answer	Mark	Notes
26	eg $\frac{6(x+3)+4(x-2)}{(x-2)(x+3)}$		5	M1 writing the addition part as a correct fraction over a common denominator – need not be expanded and may be 2 separate fractions. Allow one sign error in numerator if expanded
	eg $\frac{10(x+1)}{(x-2)(x+3)}$ or $\frac{10x+10}{x^2+x-6}$ oe			A1 a correct single fraction with numerator and denominator simplified – numerator and / or denominator may be factorised. This implies the 1st M1
	$\frac{(5x-5)(x-2)}{(x+1)(x-1)}$ or $\frac{(5x-10)(x-1)}{(x+1)(x-1)}$			M1 for numerator **or** denominator factorised correctly into 2 brackets
	$\frac{5(x-1)(x-2)}{(x+1)(x-1)}$ or $\frac{5(x-2)}{(x+1)}$ oe			M1 for numerator **and** denominator fully factorised correctly including factor of 5 taken out (could be implied by further cancelling) This implies the 2nd M1
		$\frac{50}{x+3}$		A1 dep on M3
ALT	$\frac{(5x-5)(x-2)}{(x+1)(x-1)}$			M1 for numerator **or** denominator factorised correctly
	$\frac{5(x-1)(x-2)}{(x+1)(x-1)}$ or $\frac{5(x-2)}{(x+1)}$			M1 for numerator **and** denominator fully factorised correctly including factor of 5 taken out (could be implied by further cancelling)
	$\frac{30(x+3)+20(x-2)}{(x+1)(x+3)}$ oe			M1 for multiplying each part and writing the addition as a correct fraction over a common denominator – need not be expanded and may be 2 separate fractions. Allow one sign error in numerator if expanded
	$\frac{50x+50}{(x+1)(x+3)}$ or $\frac{50(x+1)}{(x+1)(x+3)}$			M1 for numerator **and** denominator fully factorised correctly (could be implied by further cancelling)
		$\frac{50}{x+3}$		A1 dep M3
	wr			**Total 5 marks**