1		Proof	M1	starts process to find point of intersection by substituting, eg $(10 + 2y)^2 + y^2 (= 20)$	
		(supported)	M1	for expanding, eg $4y^2 + 20y + 20y + 100$ (3 out of 4 terms correct)	
			M1	(dep M2) for 3-term quadratic equation ready for solving, eg $5y^2 + 40y + 80 = 0$	
			M1	(dep on previous M1) for method to solve an equation of the form $ay^2 + by + c = 0$, eg by factorising or correct substitution into quadratic formula	
			C1	fully correct method leading to $y = -4$ or $x = 2$ or $(y + 4)^2 = 0$ or $(x - 2)^2 = 0$ and statement, eg only one point of intersection so the line is a tangent to the circle	

2	(a)	Correct graph	B2	for a circle radius 3.5, centre (0, 0)	Circle could be drawn freehand as long as it approximates to a circle
			(B1	for a circle centre (0, 0) of a different radius, **or** for a circle drawn of radius 3.5 centre not (0, 0) **or** incomplete correct circle)	
	(b)	$x = 2.0, y = -2.9$ $x = -1.2, y = 3.3$	M1	for $2x + y = 1$ drawn, **or** for correctly eliminating one variable, eg $x^2 + 1 - 4x + 4x^2 = 12.25$ or $x^2 + (1 - 2x)^2 = 12.25$	
			A1	for the pair of x values, **or** the correct pair of y values, **or** one correct pair of x/y values ft from (a) (dep on B1)	$2x + y = 1$ does not have to be shown Use professional judgment
			A1	for both correct pair of x/y values, unambiguously matched ft from (a) (dep on B1)	Accept values given as coordinates. Check graph for answers

3		2.5	P1	use of $\sin 30 = \frac{1}{2}$ to find $OA (= 8)$ or $OAB = 90°$ eg $OA = 16\sin 30°$ or right angle marked on diagram	
			P1	recognition that equation of circle is $x^2 + y^2 = r^2$	Accept $3p^2 + p^2 = r^2$ for the award of this mark
			P1	Correct substitution of p, $3p$ and r in $x^2 + y^2 = r^2$ eg $9p^2 + p^2 = OA^2$ or $(3p)^2 + p^2 = "8^2"$	Do not accept $3p^2 + p^2 = 8^2$ for the award of this mark
			A1	for answer in the range 2.5 to 2.53	Accept $\sqrt{6.4}$ or $\frac{4\sqrt{10}}{5}$ If an answer within the given range is seen in working and rounded incorrectly award full marks. Award 0 marks for the answer without supportive working.

4	$x^2 + y^2 = 80$		P1	for process to find gradient of tangent eg $\frac{10-0}{0--20}$ $(=\frac{1}{2})$ **or** for $20^2 + 10^2 (= 500)$ **or** start to method to find angle between tangent and x axis, eg $\tan\theta = \frac{10}{20}$	
			P1	for process to find gradient of normal/radius eg $\frac{-1}{"0.5"}$ $(=-2)$ **or** for $\sqrt{20^2 + 10^2}$ or $\sqrt{500}$ or 22.36... or 22.4 **or** completes process to find angle between tangent and x axis. eg $\theta = \tan^{-1}\left(\frac{10}{20}\right)$ $(=26.565...)$	
			P1	for equation of tangent eg $y = "0.5"x + 10$ oe or for equation of radius eg $y = "-2"x$ oe **or** for using similar triangles eg $\frac{r}{10} = \frac{20}{"\sqrt{500}"}$ **or** for $\sin("26.565...") = \frac{r}{20}$	
			P1	for process to find the x coordinate eg $"0.5"x + 10 = "-2"x (x = -4)$ **or** for $r = \frac{20}{"\sqrt{500}"} \times 10$ **or** $r = 20 \times \sin("26.565...")$	
			A1	oe	Accept $(4\sqrt{5})^2$ for 80

5	$x = 2.1, y = 5.1$ $x = -2.9, y = -4.7$	M1	for drawing the graph of $y - 2x = 1$	
		A1	for one correct pair of values **or** for both correct x values, **or** for both correct y values	For both A marks accept answers in the ranges $x = 2.0$ to 2.2, $y = 5.0$ to 5.2 $x = -2.8$ to -3.0, $y = -4.6$ to -4.8 Accept values given as coordinates
		A1	for both correct pairs, correctly matched	

6	0.7 to 1.1	M1	for tangent to the curve drawn at $t = 12$	
		M1	for method to find the gradient of their tangent, eg $28 \div 30$	Working may be seen on the diagram
		A1	for answer in the range 0.7 to 1.1 dependent upon tangent drawn	Ignore negative signs