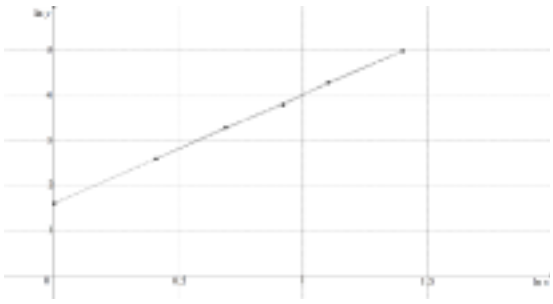
Question	Answer	Marks	Guidance
4	$5x^2-8x-4\ \ (=0)$ or $5y^2-36y-305\ \ (=0)$	**M1**	For attempt to eliminate one variable to obtain a 3 term quadratic equation (= 0). Allow one sign error.
	$x=-\frac{2}{5},\ x=2$ $y=-\frac{61}{5},\ y=-5$	**3**	**Dep M1** for attempt to solve *their* quadratic equation **A1** for any correct pair **A1** for a second correct pair.
	Mid-point $\left(\frac{4}{5},\ -\frac{43}{5}\right)$	**M1**	For attempt to find mid-point using *their* coordinates
	Gradient of perpendicular = $-\frac{1}{3}$	**B1**	
	$y+\frac{43}{5}=-\frac{1}{3}\left(x-\frac{4}{5}\right)$	**M1**	For attempt to find the equation of the perpendicular bisector using *their* perpendicular gradient and *their* midpoint. Allow alternative methods
	$a=-1$	**A1**	
5(a)	$x^{20}-40x^{16}+720x^{12}$	**3**	**B1** for each correct term
5(b)	$\left(x^4+4+\frac{4}{x^4}\right)$	**B1**	Allow unsimplified
	$\left(4\times their\ -40\right)+4+their720$ soi	**M1**	Must have 3 terms
	564	**A1**	
6(a)	$\frac{1}{2}r^2\theta=25$ $\theta=\frac{50}{r^2}$	**B1**	
	$P=2r+\frac{50}{r}$	**2**	**M1** for use of $P=2r+r\theta$ with attempt to eliminate θ

Question	Answer	Marks	Guidance
6(b)	$\frac{dP}{dr} = 2 - \frac{50}{r^2}$	**M1**	For attempt to differentiate *their P*, must be in terms of *r*.
	When $\frac{dP}{dr} = 0,\ r = 5$	**A1**	
	$\frac{d^2P}{dr^2} = \frac{100}{r^3}$ When $r = 5,\ \frac{d^2P}{dr^2}$ is positive so a minimum oe.	**B1**	Allow alternative valid methods
	Minimum $P = 20$	**A1**	
7(a)	<table><tr><td>ln *x*</td><td>0.41</td><td>0.69</td><td>0.92</td><td>1.1</td><td>1.4</td></tr><tr><td>ln *y*</td><td>2.6</td><td>3.3</td><td>3.8</td><td>4.3</td><td>5</td></tr></table>	**3**	**M1** for attempt to find ln values of all and plotting the graph. **A1** for 4 correct points. **A0** for fewer than 4 correct points.
7(b)	$\ln y = \ln A + b \ln x$ soi	**B1**	Allow if seen in (a)
	Gradient = $b = 2.4$ Allow 2.3 to 2.5	**2**	**Dep M1** for attempt to find the gradient of *their* graph, must have **M1** in part(a) Must be using points on *their* graph.
	$\ln A = 1.6$ $A = 5$ Allow awrt 4.8 to awrt 5.5	**2**	**Dep M1** for attempt to find the intercept on the vertical axis and equate to ln *A*. must have **M1** in part (a).
7(c)	$x = 3.42$ Allow 3.2 to 3.5	**2**	**M1** for a correct attempt to find the estimate either using *their* graph or *their* equation.
8(a)	**b** – **a**	**B1**	