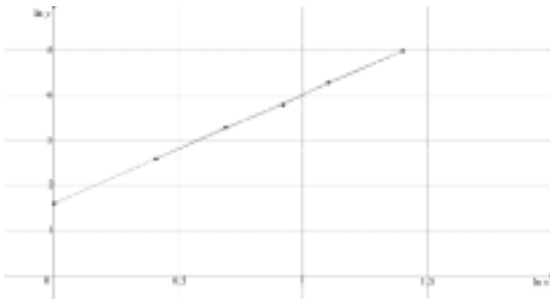
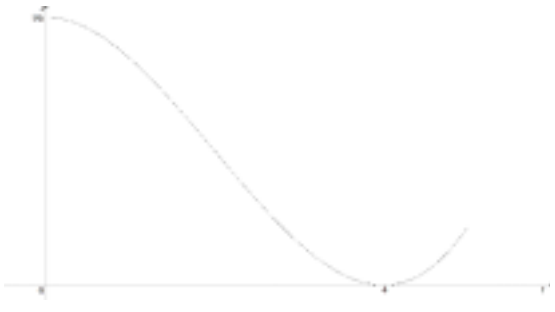
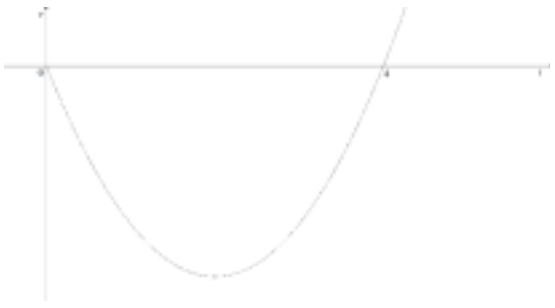
Question	Answer	Marks	Guidance
6(b)	$\frac{dP}{dr} = 2 - \frac{50}{r^2}$	**M1**	For attempt to differentiate *their P*, must be in terms of *r*.
	When $\frac{dP}{dr} = 0,\ r = 5$	**A1**	
	$\frac{d^2P}{dr^2} = \frac{100}{r^3}$ When $r = 5,\ \frac{d^2P}{dr^2}$ is positive so a minimum oe.	**B1**	Allow 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**	

Question	Answer	Marks	Guidance
8(b)	$\frac{2}{5}\mathbf{a}+\frac{1}{2}\left(their\ \left(\mathbf{b}-\mathbf{a}\right)\right)$ soi oe	**M1**	
	$\frac{1}{2}\mathbf{b}-\frac{1}{10}\mathbf{a}$	**A1**	Allow unsimplified
8(c)	$\left(\lambda+1\right)\times\left(\frac{1}{2}\mathbf{b}-\frac{1}{10}\mathbf{a}\right)$ oe	**2**	**M1** for $\left(\lambda+1\right)\times their\left(\frac{1}{2}\mathbf{b}-\frac{1}{10}\mathbf{a}\right)$ **A1** allow unsimplified
8(d)	$-\frac{3}{5}\mathbf{a}+\left(\mu+1\right)\mathbf{b}$ oe	**2**	**B1** for each vector, allow unsimplified.
8(e)	$\left(\lambda+1\right)\times\left(\frac{1}{2}\mathbf{b}-\frac{1}{10}\mathbf{a}\right)=-\frac{3}{5}\mathbf{a}+\left(\mu+1\right)\mathbf{b}$ $\lambda=5$ $\mu=2$	**3**	**M1** for equating $\left(\lambda+1\right)\times their\left(\frac{1}{2}\mathbf{b}-\frac{1}{10}\mathbf{a}\right)$ and *their* $-\frac{3}{5}\mathbf{a}+\left(\mu+1\right)\mathbf{b}$ **and** then equating like vectors at least once. **A1** for each.
9(a)	$v=9t\left(t-4\right)$ oe	**2**	**M1** for correct attempt to differentiate, allow one arithmetic error.
	$t=0,\ t=4$	**2**	**Dep M1** for equating *their v* to zero and attempt to solve. **A1** for both.
9(b)		**3**	**B1** for correct cubic curve for given domain **B1** for $\left(0,\ 96\right)$ and no other intercept on the *y*-axis **B1** for touching at $\left(4,\ 0\right)$ and no other intercept on the *x*-axis
9(c)		**2**	**B1** for a correct quadratic curve for the given domain, starting from the origin. **B1** for $\left(4,\ 0\right)$ and no other *x*- intercept
9(d)(i)	$18t-36$	**B1**	

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