Question Number	Scheme	Marks
8.	(a) $\frac{dy}{dx} = 4 - \frac{25}{(x-2)^2}$	M1 A1
	At TP, $4 - \frac{25}{(x-2)^2} = 0$	M1
	$\pm 2 = \frac{5}{x-2}$	
	$x = 2 \pm \frac{5}{2} = -\frac{1}{2}$ or $4\frac{1}{2}$	M1 A1
	$y = -2 + 8 + \frac{25}{-2\frac{1}{2}} = -4$, $y = 18 + 8 + \frac{25}{2\frac{1}{2}} = 36$	A1
	Stationary points $(-\frac{1}{2}, -4)$ and $(4\frac{1}{2}, 36)$	(6)
	(b) $\frac{d^2y}{dx^2} = \frac{50}{(x-2)^3}$	M1
	At $(-\frac{1}{2}, -4)$, $\frac{d^2y}{dx^2} = \frac{50}{(-2\frac{1}{2})^3} < 0$, maximum	M1 (either point)
	$(4\frac{1}{2}, 36)$, $\frac{d^2y}{dx^2} = \frac{50}{(2\frac{1}{2})^3} > 0$, minimum	A1 (both points)
	or consider gradient either side of each point.	(3) **[9]**
9.	(a) $v = 2t + c$	M1
	$t = 0$, $v = 6$ so $c = 6$ and $v = 2t + 6$	A1 (2)
	(b) $s = t^2 + 6t + k$	M1
	$t = 0$, $s = 0$ so $k = 0$ and $s = t^2 + 6t$ *	A1 (2)
	(c) $v = 3t^2 + d$	M1
	$t = 0$, $v = 0$ so $d = 0$ and $v = 3t^2$	A1 (2)
	(d) $s = t^3 + h$	M1
	$t = 0$, $s = 0$ so $h = 0$ and $s = t^3$	A1 (2)
	(e) $\lvert(5^3) - (5^2 + 6 \times 5)\rvert = 70$	M1A1ft (2)
	(f) $t^2 + 6t = t^3$	M1
	$t^3 - t^2 - 6t = 0$	
	$t(t - 3)(t + 2) = 0$	M1
	$t = 3$ (as $t > 0$)	A1 (3) **[13]**

Question Number	Scheme	Marks
10.	(a) (i) $\overrightarrow{BC} = 6\mathbf{i} + 6\mathbf{j} - (3\mathbf{i} + 5\mathbf{j})$	B1
	(ii) $\overrightarrow{BC} = 3\mathbf{i} + \mathbf{j} = \frac{1}{3}\overrightarrow{AD}$	M1
	So BC is parallel to AD, *and* $ABCD$ is a trapezium. *	A1
		(3)
	(b) (i) $\overrightarrow{BD} = 9\mathbf{i} + 3\mathbf{j} - (3\mathbf{i} + 5\mathbf{j}) = 6\mathbf{i} - 2\mathbf{j}$	M1
	$\left\lvert\overrightarrow{BD}\right\rvert = \sqrt{36+4} = \sqrt{40} = 2\sqrt{10}$	M1 A1
	(ii) unit vector is $\frac{1}{2\sqrt{10}}(6\mathbf{i} - 2\mathbf{j})$ or $\frac{-1}{2\sqrt{10}}(6\mathbf{i} - 2\mathbf{j})$	B1ft
		(4)
	(c) $\overrightarrow{AF} = \overrightarrow{AB} + \frac{1}{3}\overrightarrow{BD}$ *or* $\frac{2\overrightarrow{AB} + \overrightarrow{AD}}{3}$	M1
	$= (3\mathbf{i} + 5\mathbf{j}) + \frac{1}{3}(6\mathbf{i} - 2\mathbf{j})$ *or* $\frac{2(3\mathbf{i} + 5\mathbf{j}) + (9\mathbf{i} + 3\mathbf{j})}{3}$	A1
	$= 5\mathbf{i} + 4\frac{1}{3}\mathbf{j}$	
		(2)
	(d) (i) $\overrightarrow{EC} = 3\mathbf{i} + 5\mathbf{j}$	B1
	$\overrightarrow{EF} = \overrightarrow{EA} + \overrightarrow{AF} = -\overrightarrow{BC} + \overrightarrow{AF}$	
	$= -3\mathbf{i} - \mathbf{j} + 5\mathbf{i} + 4\frac{1}{3}\mathbf{j} = 2\mathbf{i} + 3\frac{1}{3}\mathbf{j}$	M1 A1
	$= \frac{2}{3}(3\mathbf{i} + 5\mathbf{j})$	M1
	$\overrightarrow{EF} = \frac{2}{3}\overrightarrow{EC}$, so F lies on EC *	A1
	(ii) $EF : FC = 2 : 1$	B1
		(6)
		[15]

Question Number	Scheme	Marks
11.	(a) (i) $AC^2 = 10^2 + 10^2 = 200$, $AC = 10\sqrt{2}$	M1 A1
	(ii) $EG^2 = 4^2 + 4^2 = 32$, $EG = 4\sqrt{2}$	M1 A1
	(iii) $AP = \frac{1}{2}(10\sqrt{2} - 4\sqrt{2}) = 3\sqrt{2}$	M1 A1 ft (6)
	(b) $AE^2 = 12^2 + (3\sqrt{2})^2 = 144 + 18 = 162$	M1
	$AE = 12.7$ cm (3sf)	A1 (2)
	(c) $\tan EAP = \frac{12}{3\sqrt{2}} \Rightarrow \angle EAP = 70 \cdot 5^o$	M1 A1 (2)
	(d) (i) $PQ = \frac{1}{2}(10-4) = 3$	B1
	(ii) $AQ = 3$	B1 (2)
	(e) $\cos EAB = \frac{3}{\sqrt{162}} \Rightarrow \angle EAB = 76.4^o$	M1 A1 (2)
	(f) Angle required is PQE	B1
	$\tan BQE = \frac{12}{3} \Rightarrow BQE = 76.0^o$	M1 A1 (3) **[17]**

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