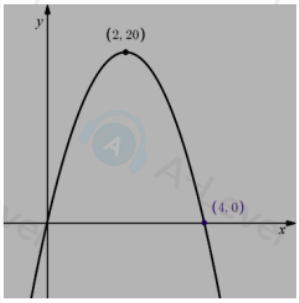
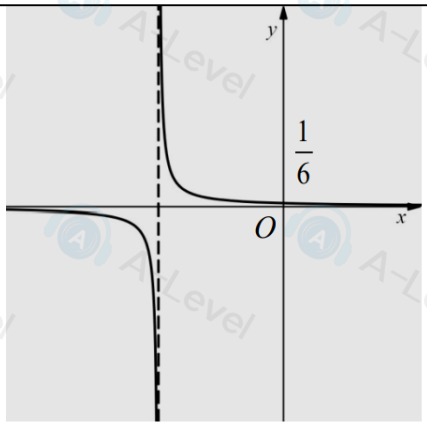
Question Number	Scheme	Marks
9 (a)	 Correct shape and position passing through (0, 0) Intersection at (4, 0)	B1 B1 **(2)**
(b)	Attempts form of equation. E.g. $y = Ax(x-4)$ or $y = 20 \pm C(x-2)^2$ Full attempt to find equation. E.g. $20 = A \times 2(2-4) \Rightarrow A = ...$ Or $0 = 20 + C(4-2)^2 \Rightarrow C = ...$ $y = -5x(x-4)$, $y = 20 - 5(x-2)^2$ o.e.	M1 dM1 A1 **(3)**
(c)	Sets $x\left(x^2-4\right) = "-5x(x-4)"$ $x^3 + 5x^2 - 24x = 0 \Rightarrow x\left(x^2+5x-24\right) = 0$ $(x+8)(x-3) = 0 \Rightarrow x$ coordinate of P is -8 $P = \left(-8, -480\right)$	M1 dM1 ddM1, A1 A1 **(5)** **(10 marks)**

Question Number	Scheme	Marks
1	$x^n \rightarrow x^{n+1}$ $\int\left(8x^3 - 6\sqrt{x} - \frac{2}{5x^3}\right)\mathrm{d}x = 2x^4 - 4x^{\frac{3}{2}} + \frac{1}{5x^2} + c$	M1 A1A1A1
		(4 marks)

Question Number	Scheme	Marks
8	$x - 6x^{\frac{1}{2}} + 4 = 0$ $x^{\frac{1}{2}} = 3 \pm \sqrt{5}$ oe $x = \left(3 \pm \sqrt{5}\right)^2 \Rightarrow x = 14 \pm 6\sqrt{5}$	M1 A1 M1 A1 A1 **(5 marks)**

Question Number	Scheme	Marks
5 (a)	Attempts the gradient $\frac{\Delta y}{\Delta x}=\frac{9-6}{-2-10}=\left(-\frac{1}{4}\right)$	M1
	Uses the gradient and a point to form an eqn for l_1 $y-9=-\frac{1}{4}(x+2)$	dM1
	$y=-\frac{1}{4}x+\frac{17}{2}$	A1
		(3)
(b)	Eqn of l_2 is $y=4x$	B1ft
	Attempts to solve their $y=4x$ and their $y=-\frac{1}{4}x+\frac{17}{2}$ simultaneously	M1
	$R=(2,8)$	A1, A1
		(4)
(c)	Attempts $(OR)=\sqrt{"2"^2+"8"^2}$ or $(PQ)=\sqrt{3^2+12^2}$	M1
	Full attempt at area $OPQ=\frac{1}{2}\times\sqrt{3^2+12^2}\times\sqrt{2^2+8^2}$	dM1
	$=\frac{1}{2}\times3\sqrt{17}\times2\sqrt{17}=51$	A1
		(3)
		(10 marks)

Question Number	Scheme		Marks
7(a)	 $x=-6$	Correct shape and position	B1
		Correct **equation** of vertical asymptote. E.g. $x=-6$ oe e.g. $x+6=0$	B1
		Correct y intercept $\left(0,\frac{1}{6}\right)$	B1
			(3)

(b)(i)	$mx-4=\frac{1}{x+6}\Rightarrow(mx-4)(x+6)=1$	M1
	$\Rightarrow mx^2+(6m-4)x-25=0$ or $mx^2+6mx-4x-25=0$	A1
	$"b^2-4ac"=(6m-4)^2-4\times m\times(-25)$	dM1
	$\Rightarrow(6m-4)^2+100m\ldots0$ $\Rightarrow36m^2+52m+16\ldots0\Rightarrow9m^2+13m+4\ldots0$ *	A1*
(ii)	$(m+1)(9m+4)\ldots0\Rightarrow\quad m\,,,\,-1,\quad m\ldots-\frac{4}{9}$	M1 A1
		(6)

Question Number	Scheme	Marks
3(a)	$58^2 = a + 5^3 \times b$, $65^2 = a + 10^3 \times b \Rightarrow a = ...$, or $b = ...$	M1
	$a = 3241,\ b = 0.984$	A1A1
		(3)
(b)	e.g. $85^2 = "3241" + "0.984" \times T^3 \Rightarrow T = ...$	M1
	$(T =)$ awrt 15.9	A1
		(2)
		(5 marks)

Question Number	Scheme	Marks
2(a)	$6 = 5a + b,\ 3.3 = 8a + b$	M1 A1
	$a = -0.9, b = 10.5$	dM1 A1
		(4)
(b)(i)	$10.5\ \text{m}^3$	B1ft
(ii)	$-0.9\sqrt{t} + 10.5 = 0 \Rightarrow 0.9\sqrt{t} = 10.5 \Rightarrow t = ...$	M1
	$t = 136\ (\text{min})$	A1
		(3)
		(7 marks)

Question Number	Scheme	Marks
4	$\int \frac{3x^{\frac{3}{2}} - 15x^{\frac{1}{2}} + 2x - 10}{4\sqrt{x}}\,dx = \int \frac{3}{4}x - \frac{15}{4} + \frac{1}{2}x^{\frac{1}{2}} - \frac{5}{2}x^{-\frac{1}{2}}\,dx$	M1A1A1
	$x^n \rightarrow x^{n+1}$	dM1
	$\frac{3}{8}x^2 - \frac{15}{4}x + \frac{1}{3}x^{\frac{3}{2}} - 5x^{\frac{1}{2}} + C$	A1A1
		(6 marks)

Question Number	Scheme	Marks
9 (a)	$x \ldots -5$	B1 **(1)**
(b)	$f(x) = (x+5)\left(3x^2 - 4x + 20\right) = 3x^3 + 11x^2 + 100$	M1
	$f'(x) = 9x^2 + 22x$	M1 A1cso **(3)**
(c)	Finds $f'(-4) = 9\times\left(-4\right)^2 + 22\times -4 = \left(56\right)$	M1
	Sets $f'(x) = "9x^2 + 22x" = "56"$	dM1
	$9x^2 + 22x - 56 = 0 \Rightarrow x = \frac{14}{9}, \left(-4\right)$	ddM1 A1cso **(4)**
(d)(i)	$\left(-1, 84\right)$	B1
(ii)	$\left(-4, 336\right)$	B1 **(2)** **(10 marks)**

Question Number	Scheme	Marks
2. (a)	$5(x+3) > 4(2x-5) \Rightarrow 5x+15 > 8x-20 \Rightarrow ax > b$ or $px < q$	M1
	$\Rightarrow x < \frac{35}{3}$	A1 **(2)**
(b) (i)	$x^2 - 6x + 1 = (x-3)^2 \pm \ldots = (x-3)^2 - 8$	M1, A1
(ii)	$(x-3)^2 - 8 = 0 \Rightarrow x = 3+\sqrt{8}$ or $3-\sqrt{8}$	M1
	$x^2 - 6x + 1 \geqslant 0 \Rightarrow x \leqslant 3-\sqrt{8}, x \geqslant 3+\sqrt{8}$	A1 **(4)**
(c)	$x \leqslant 3-\sqrt{8},\ 3+\sqrt{8} \leqslant x < \frac{35}{3}$	B1 **(1)** **(7 marks)**

Question Number	Scheme	Marks
5.(a)	$\frac{dy}{dx} = \frac{1}{2}x^2 + 2x^{-\frac{1}{2}}$	M1A1 A1 **(3)**
(b)	$\left.\frac{dy}{dx}\right\|_{x=4} = \frac{1}{2}\times 4^2 + 2\times\frac{1}{\sqrt{4}} = (9)$	M1
	Gradient of normal is $-\frac{1}{9}$	dM1
	$y - \frac{11}{3} = -\frac{1}{9}(x-4) \Rightarrow x + 9y - 37 = 0$	M1 A1 **(4)** **(7 marks)**

	$-a+6a+8+a^2=32 \Rightarrow a^2+5a-24=0$	M1
	$(a+8)(a-3)=0$	dM1
	$a=3$ or $a=-8$ and chooses $a=3$ with reason *	A1* cso
		(3)
(ii)	$3x^3+26x^2-9x=0 \Rightarrow x(3x^2+26x-9)=0$	M1
	$x(3x-1)(x+9)$	
	$(x=)\ 0, \frac{1}{3}, -9$	A1
		(2)
(b)(i)	$(y=)\ 0$	B1
	$y^{\frac{1}{3}}="\frac{1}{3}"$ or $y^{\frac{1}{3}}="-9" \Rightarrow y=...$ (or $(-9)^3=...$ or $\left(\frac{1}{3}\right)^3=...$)	M1
	$(y=)\ \frac{1}{27},\ -729$	A1
		(3)
(b)(ii)	$9^z="\frac{1}{3}" \rightarrow z=...$	M1
	$(z=)\ -\frac{1}{2}$ only	A1
		(2)
		(10 marks)

Question Number	Scheme	Marks
4(i)	Uses a correct law of indices on 2^{4k-3} or 8^{1-k} The possibilities are endless but some more common examples are: For 2^{4k-3}: $2^{4k}\times 2^{-3}$, $\frac{2^{4k}}{8}$, $8^{\frac{4k-3}{3}}$, $4^{\frac{4k-3}{2}}$, $\left(\sqrt{2}\right)^{8k-6}$ For 8^{1-k}: 8×8^{-k}, $\frac{8}{8^{k}}$, $2^{3(1-k)}$, $4^{\frac{2(1-k)}{3}}$, $\left(\sqrt{2}\right)^{6-6k}$ These may be seen in isolation e.g. not in an equation. But not just e.g. $8=2^3$	M1
	e.g. $2^{4k-3}=\frac{8^{1-k}}{4\sqrt{2}}\Rightarrow 2^{4k-3}=\frac{2^{3(1-k)}}{2^{\frac{5}{2}}}\Rightarrow 2^{4k-3}=2^{3(1-k)-\frac{5}{2}}$ $\Rightarrow 4k-3=3(1-k)-\frac{5}{2}\Rightarrow k=...$	dM1
	$k=\frac{1}{2}$	A1
		(3)

(ii)	$\frac{x\sqrt{3}+2}{\sqrt{3}-1}=x\sqrt{3}-4\Rightarrow x\sqrt{3}+2=\left(x\sqrt{3}-4\right)\left(\sqrt{3}-1\right)$ $\Rightarrow x\sqrt{3}+2=3x+4-4\sqrt{3}-x\sqrt{3}$ $\Rightarrow 2\sqrt{3}x-3x=2-4\sqrt{3}$	M1
	$\Rightarrow x\left(2\sqrt{3}-3\right)=2-4\sqrt{3}$	A1
	$\Rightarrow x=\frac{2-4\sqrt{3}}{2\sqrt{3}-3}\times\frac{2\sqrt{3}+3}{2\sqrt{3}+3}$	dM1
	$=-6-\frac{8}{3}\sqrt{3}$	A1
		(4)