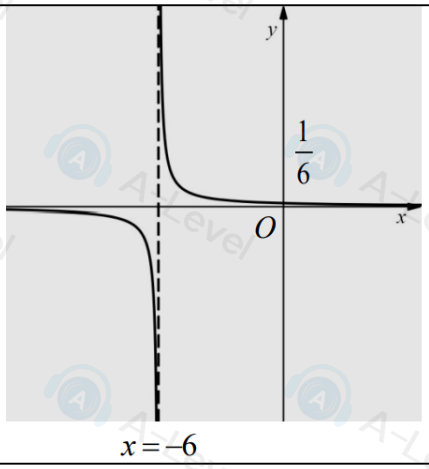
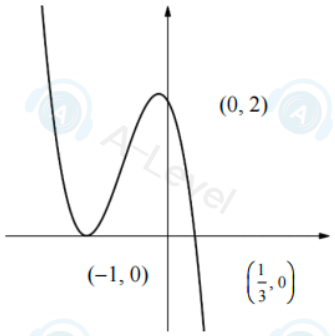
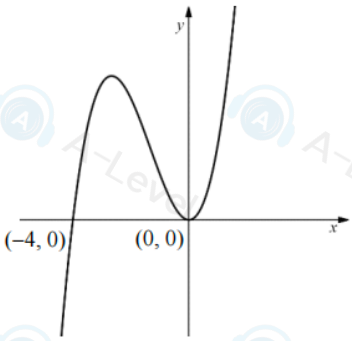
Question Number	Scheme	Marks
7(a)	 Correct shape and position	B1
	Correct **equation** of vertical asymptote. E.g. $x=-6$ oe e.g. $x+6=0$	B1
	Correct y intercept $\left(0,\frac{1}{6}\right)$	B1
		(3)

(b)(i)	$mx-4=\frac{1}{x+6}\Rightarrow\left(mx-4\right)\left(x+6\right)=1$	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
	$\Rightarrow(6m-4)^2+100m\ldots0$ $\Rightarrow 36m^2+52m+16\ldots0\Rightarrow 9m^2+13m+4\ldots0$ *	A1*
(ii)	$(m+1)(9m+4)\ldots0\Rightarrow\quad m\,,,\,-1,\quad m\ldots-\frac{4}{9}$	M1 A1
		(6)

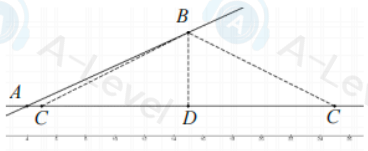
(b)		B1B1B1
		(3)
		Total 6

3(a)		B1B1B1
		(3)

Question Number	Scheme	Marks
6.(a)	$f'(x) = 5x^{\frac{3}{2}} - 40$	M1A1
	Attempts $5x^{\frac{"3"}{2}} - 40 = 0 \Rightarrow x^{\frac{"3"}{2}} = ..$ $x = 4$	M1 A1 cao (4)
(b)	$f''(x) = \frac{15}{2}x^{\frac{1}{2}} = 5$	M1
	$\Rightarrow x^{\frac{1}{2}} = .. \Rightarrow x = ..^2$ $\quad x = \frac{4}{9}$	M1 A1 (3) **(7 marks)**

Question	Scheme	Marks
4(a)	$x^2 + kx - 9 = -3x^2 - 5x + k \Rightarrow 4x^2 + kx + 5x - 9 - k\,(=0)$	M1
	$b^2 - 4ac = 0 \Rightarrow (k+5)^2 - 4\times 4(-9-k) = 0$	M1
	$k^2 + 26k + 169 = 0$*	A1*
		(3)
(b)	$k^2 + 26k + 169 = 0 \Rightarrow k = -13$	B1
	$k = -13 \Rightarrow 4x^2 - 8x + 4 = 0 \Rightarrow x = ...$	M1
	$(1, -21)$	A1
		(3)
		Total 6

Question Number	Scheme	Marks
11(a)	States or implies that the gradient of the normal is $-\frac{1}{3}$	M1
	Correct equation of normal e.g. $y - 16 = -\frac{1}{3}(x-4)$	A1
		(2)
(b)	$f''(x) = 4x + x^{-\frac{1}{2}} \Rightarrow f'(x) = 2x^2 + 2x^{\frac{1}{2}} + c$	M1
	$x = 4, f'(x) = 3 \Rightarrow\ 3 = 32 + 4 + c \Rightarrow c = ...(-33)$	dM1
	$f'(x) = 2x^2 + 2x^{\frac{1}{2}} - 33$	A1
	$f'(x) = 2x^2 + 2x^{\frac{1}{2}} - 33 \Rightarrow f(x) = \frac{2}{3}x^3 + \frac{4}{3}x^{\frac{3}{2}} - 33x + d$	dM1
	$x = 4, f(x) = 16 \Rightarrow (f(x) =)\frac{2}{3}x^3 + \frac{4}{3}x^{\frac{3}{2}} - 33x + \frac{284}{3}$	ddM1A1
		(6)
		(8 marks)

Question	Scheme	Marks
9(a)	$m=\dfrac{7-2}{15-4}\left(=\dfrac{5}{11}\right)$	M1
	$y-2=\dfrac{5}{11}(x-4)$ or $y-7=\dfrac{5}{11}(x-15)$ or $y=\dfrac{5}{11}x+c\Rightarrow 2=\dfrac{5}{11}\times 4+c\Rightarrow c=\ldots\left(\dfrac{2}{11}\right)$	M1
	$5x-11y+2=0$	A1
		(3)
(a) ALT	$y=mx+c\Rightarrow \begin{matrix}2=4m+c\\7=15m+c\end{matrix}$	M1
	$\begin{matrix}2=4m+c\\7=15m+c\end{matrix}\Rightarrow m=\ldots\left(\dfrac{5}{11}\right),\quad c=\ldots\left(\dfrac{2}{11}\right)$	M1
	$5x-11y+2=0$	A1
(b)	$(15-x)^2+(7-2)^2=\left(5\sqrt{5}\right)^2$ or e.g. $\sqrt{(15-x)^2+(7-2)^2}=5\sqrt{5}$ or e.g. $\left(5\sqrt{5}\right)^2=5^2+CD^2$ oe 	M1
	Way 1: $(15-x)^2+25=125\Rightarrow(15-x)^2=100\Rightarrow x=\ldots$ or e.g. Way 2: $125=25+CD^2\Rightarrow CD^2=100\Rightarrow CD=10\Rightarrow x=\ldots$	M1
	$(5,\ 2)$ **or** $(25,\ 2)$	A1
	$(5,\ 2)$ **and** $(25,\ 2)$	A1
		(4)
(c)	Area $=\dfrac{1}{2}("5"-4)\times 5$	M1
	$=\dfrac{5}{2}$	A1
		(2)
		Total 9

Question	Scheme	Marks
7(a)	$0=10-2x \Rightarrow x=5$ or $y=2, y=10-2x \Rightarrow x=4$	B1
	Examples: $\frac{1}{2}\times 2\left(5+4-a\right)=\frac{27}{4}$ or $\frac{1}{2}\times 2\left(5+4-\frac{2}{k}\right)=\frac{27}{4}$ Trapezium or $\frac{1}{2}\times 2a+\frac{1}{2}\times 2\left(5-a+4-a\right)=\frac{27}{4}$ or $\frac{1}{2}\times 2\times\frac{2}{k}+\frac{1}{2}\times 2\left(5-\frac{2}{k}+4-\frac{2}{k}\right)=\frac{27}{4}$ Triangle + Trapezium or $\frac{1}{2}\times 2a+2\left(4-a\right)+\frac{1}{2}\times 1\times 2=\frac{27}{4}$ or $\frac{1}{2}\times 2\times\frac{2}{k}+2\left(4-\frac{2}{k}\right)+\frac{1}{2}\times 1\times 2=\frac{27}{4}$ Triangle + Rectangle + Triangle or $\frac{1}{2}\times 5\times 2+\frac{1}{2}\left(4-a\right)\times 2=\frac{27}{4}$ or $\frac{1}{2}\times 5\times 2+\frac{1}{2}\left(4-\frac{2}{k}\right)\times 2=\frac{27}{4}$ 2 Triangles	M1
	$\Rightarrow k=\frac{8}{9}, a=\frac{9}{4}$	A1 A1ft
		(4)
(b)	Two of $y\geqslant "\frac{8}{9}"x,\ y\leqslant 10-2x, x>"\frac{9}{4}"$	M1
	All three of $y\geqslant \frac{8}{9}x,\ y\leqslant 10-2x, x>\frac{9}{4}$	A1
		(2)
		(6 marks)

Question Number	Scheme	Marks
2a	$\frac{1}{8}x$	B1
		(1)
b	$\frac{1}{256}x^{\frac{3}{2}}$	B1
		(1)
c	$\left(\frac{1}{2}\left(\frac{1}{64}x^2\times\frac{16}{\sqrt{x}}\right)\right)^{-\frac{4}{3}}=\left(\frac{1}{8}x^{\frac{3}{2}}\right)^{-\frac{4}{3}}=16x^{-2}$	M1A1
		(2)
		(4 marks)

(a)

Question Number	Scheme	Marks
1.(a)	$\frac{dy}{dx} = \frac{1}{8} \times 3x^2 - 24 \times -\frac{1}{2}x^{-\frac{3}{2}}$	M1
	$\frac{dy}{dx} = \frac{3}{8}x^2 + 12x^{-\frac{3}{2}}$	A1 A1 **(3)**
(b)	$\left.\frac{dy}{dx}\right\|_{x=4} = \frac{3}{8} \times 4^2 + 12 \times 4^{-\frac{3}{2}} = (7.5)$	M1
	$y + 3 = 7.5(x-4) \Rightarrow y = 7.5x - 33$	M1 A1 **(3)** **(6 marks)**