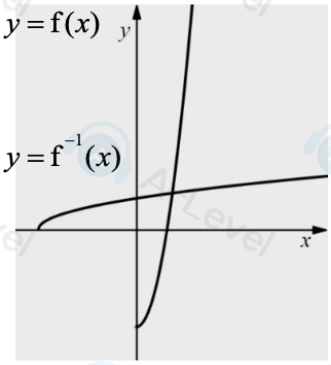
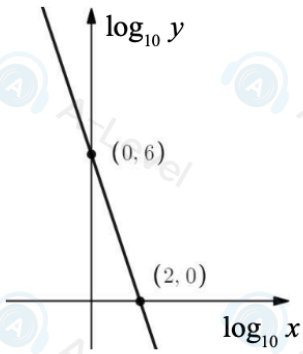
4.(a)	$f \geqslant -5$	B1 **(1)**
(b)	 Curve starting on negative x-axis and passing through positive y-axis, in quadrants 1 and 2 only. Shape and position correct.	M1 A1 **(2)**
(c)	$2x^2 - 5 = x$ or $2x^2 - 5 = \sqrt{\frac{x+5}{2}}$ or $x = \sqrt{\frac{x+5}{2}}$ or $2\left(2x^2-5\right)^2 - 5 = x$ Full attempt to solve $2x^2 - x - 5 = 0 \Rightarrow x = \ldots$ exact $x = \frac{1+\sqrt{41}}{4}$	B1 M1 A1 **(3)** **6 marks**

3 (i)	$y = \frac{10^6}{x^3} \Rightarrow \log_{10} y = \log_{10} 10^6 - \log_{10} x^3 \Rightarrow \log_{10} y = 6 - 3\log_{10} x$ 	B1 B1 B1 **(3)**
(ii)	States $\log_3 N = 2t + 4$ **or** $\log_3 N = \log_3 a + t\log_3 b$ $N = 3^{2t+4} = 3^{2t} \times 3^4$ **or** $\log_3 a = 4 \Rightarrow a = \ldots$ **or** $\log_3 b = 2 \Rightarrow b = \ldots$ $N = 81 \times 9^t$	B1 M1 A1cso **(3)** **(6 marks)**

Question Number	Scheme	Marks
7(a)	$y=\frac{16}{9(3x-k)}=\frac{16}{27x-9k}\Rightarrow\frac{dy}{dx}=-\frac{432}{(27x-9k)^2}$	M1A0
(b)	$-\frac{432}{(27x-9k)^2}=-12\Rightarrow 12(27x-9k)^2=432$	M1
	$12(27x-9k)^2=432\Rightarrow(27x-9k)^2=36\Rightarrow 27-9k=\pm 6\Rightarrow k=...$	**d**M1
	$k=\frac{7}{3},\frac{11}{3}$	A1
(c)	$y=\frac{16}{27-21}$	M1 (B1 on ePEN)
	$y-"\frac{8}{3}"=\frac{1}{12}(x-1)$	**d**M1
	$12y-x-31=0$	A1
(d)	$\int\frac{16}{27x-9k}dx=\frac{16}{27}[\ln(27x-9k)]$	M1
	$=\frac{16}{27}[\ln(27x-21)]$	A1ft
	$\frac{16}{27}[\ln(27x-21)]_1^3=\frac{16}{27}(\ln(27(3)-21)-\ln(27-21))$	**d**M1
	$=\frac{16}{27}\ln(10)$	A1

	$f(x)=8\sin x\cos x+4\cos^2 x-3$	
4(a)	States or uses $\sin 2x=2\sin x\cos x$ or $\cos 2x=\pm 2\cos^2 x\pm 1$	M1
	Uses $\sin 2x=2\sin x\cos x$ and $\cos 2x=\pm 2\cos^2 x\pm 1$ in $f(x)$	dM1
	$(f(x)=)\ 8\sin x\cos x+4\cos^2 x-3=4\sin 2x+2\cos 2x-1$	A1
		(3)
(b)	$R^2=a^2+b^2\Rightarrow R=\sqrt{20}$ or $2\sqrt{5}$	B1ft
	$\tan\alpha=\frac{b}{a}\Rightarrow\alpha=...\ (="\text{awrt } 0.464")$	M1
	$(f(x)=)\ 2\sqrt{5}\sin(2x+0.464)-1$	A1
		(3)
(c)	(i) Maximum value = $"2\sqrt{5}-1"$	B1 ft
	(ii) Solves $2x+\alpha=\frac{5\pi}{2}\Rightarrow x=...$	M1
	$(x=)$ awrt 3.69 (or $(x=)$ awrt 3.70)	A1
		(3)
		(9 marks)