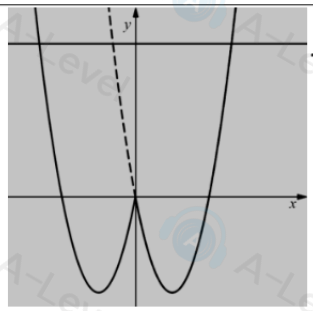
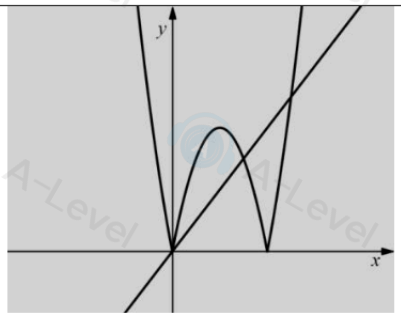
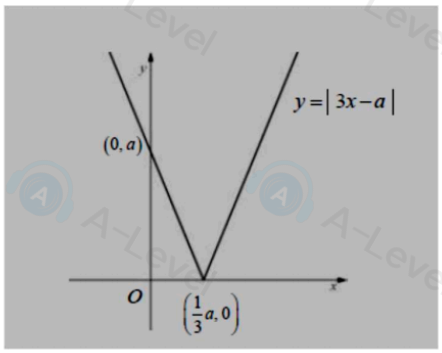
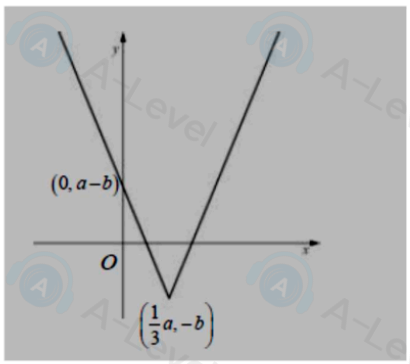
Question Number	Scheme	Marks
2(a)	$\text{ff}(6)=\text{f}\left("\frac{9}{2}"\right)=\frac{"\frac{9}{2}"+3}{"\frac{9}{2}"-4}=\ldots;\ =15$	M1; A1
		(2)
(b)	$\text{f}^{-1}(x)=\frac{4x+3}{x-1}$	M1A1
	$x\in\mathbb{R},\ x\neq 1$	B1
		(3)
(c)	E.g. $\left(\frac{x+3}{x-4}\right)^2+5=7$ or $\frac{a+3}{a-4}=(\pm)\sqrt{7-5}$	M1
	$\Rightarrow x^2-22x+23=0\Rightarrow x=\ldots$ or $(a+3)=(\pm)\sqrt{2}(a-4)\Rightarrow a=\ldots$	dM1
	$(a=)11+7\sqrt{2}$ oe	A1
		(3)

Question Number	Scheme	Marks
1(a)	$\text{f}(x)\geqslant \ln 3$	B1
		(1)
(b)	$\text{g}^{-1}(x)=\frac{3-2x}{x-5}$ or $-2-\frac{7}{x-5}$ oe $x<5$	M1A1 B1
		(3)
(c)	$\text{g}(0)=\frac{3}{2}\Rightarrow \text{f}\left(\frac{3}{2}\right)=\ln\left(\frac{21}{4}\right)$	M1A1
		(2)
(d)	$\frac{3+5\text{e}^{2a}}{\text{e}^{2a}+2}=4\Rightarrow 5\text{e}^{2a}+3=4\text{e}^{2a}+8\Rightarrow \text{e}^{2a}=\ldots$ $\text{e}^{2a}=5\Rightarrow 2a=\ln 5\Rightarrow a=\ldots$ $a=\frac{1}{2}\ln 5$	M1 dM1 A1
		(3)
		(9 marks)

(a)

3 (a)	 Graphical interpretation of $f(\lvert x \rvert)=48$	
	One of $8, -8$	B1
	Attempts to solve an appropriate equation E.g. $2x^2-10x=48 \Rightarrow x^2-5x-24=0 \Rightarrow (x\pm 8)(x\pm 3)=0 \Rightarrow x=...$	M1
	$x=8, -8$ with no additional values	A1
		(3)
(b)	 Graphical interpretation of $\lvert f(x) \rvert ... \frac{5}{2}x$ $y=\frac{5}{2}x$	
	Attempts to solve $2x^2-10x=\frac{5}{2}x \Rightarrow 4x^2-25x=0 \Rightarrow x=\frac{25}{4}$ OR attempts to solve (o.e.) $10x-2x^2=\frac{5}{2}x \Rightarrow 4x^2-15x=0 \Rightarrow x=\frac{15}{4}$	M1
	Attempts to solve $2x^2-10x=\frac{5}{2}x \Rightarrow 4x^2-25x=0 \Rightarrow x=\frac{25}{4}$ AND attempts to solve (o.e.) $10x-2x^2=\frac{5}{2}x \Rightarrow 4x^2-15x=0 \Rightarrow x=\frac{15}{4}$	dM1
	Achieves both critical values $x=\frac{15}{4}$, $x=\frac{25}{4}$	A1
	Correct set of values $x \,,, \frac{15}{4}$ or $x \,... \frac{25}{4}$	A1
		(4)

7 (a)(i)		
	Shape	B1
	Vertex $\left(\frac{1}{3}a,0\right)$	B1
	y intercept $(0,a)$	B1
(a)(ii)		
	Shape	B1ft
	Vertex $\left(\frac{1}{3}a,-b\right)$	B1ft
	y intercept $(0,a-b)$	B1ft
		(6)
(b)		
	Attempts to solve $-3x+a-b=5x \Rightarrow x=...$	M1
	$\Rightarrow x=\frac{a-b}{8}$ ONLY	A1
		(2)
		(8 marks)

5 (a)	$f^{-1}(22) \Rightarrow 2+5\ln x=22 \Rightarrow \ln x=4 \Rightarrow (x=)\ e^4$	M1 A1
		(2)
(b)	$g(x)=\frac{6x-2}{2x+1} \Rightarrow g'(x)=\frac{6(2x+1)-2(6x-2)}{(2x+1)^2}$	M1 A1
	States $(g'(x)=)\ \frac{10}{(2x+1)^2}>0$ hence increasing *	A1*
		(3)
(c)	$y=\frac{6x-2}{2x+1} \Rightarrow 2xy+y=6x-2 \Rightarrow 2xy-6x=-y-2$	M1
	$\Rightarrow x=\frac{-y-2}{2y-6}$ So $g^{-1}(x)=\frac{-x-2}{2x-6}$ o.e.	A1
	Domain $0<x<3$	B1
		(3)
(d)	Range fg is $fg<2+5\ln 3$	M1, A1
		(2)
		(10 marks)

Question Number	Scheme	Marks
8(a)	$25 = a + -(5 \times -2 + b)\ (\Rightarrow 25 = a + 10 - b) \Rightarrow a = 15 + b$ *	M1A1*
		(2)
(b)	$9 = a + 10 + b \Rightarrow a = \ldots$ or $b = \ldots.$	M1
	$a = 7,\ b = -8$	A1A1
		(3)
(c)	$\left(\frac{8}{5}, 7\right)$	B1ftB1
		(2)
(d)	$15 - 5x = -2x^3 + 5x^2 + 4x - 3 \Rightarrow 2x^3 - 5x^2 - 9x + 18 = 0$	M1
	$2x^3 - 5x^2 - 9x + 18 = (x+2)(2x^2 - 9x + 9)$	dM1A1
	$2x^2 - 9x + 9 = 0 \Rightarrow x = \frac{3}{2}$ (ignore $x = 3$)	ddM1
	$\left(\frac{3}{2}, \frac{15}{2}\right)$	M1A1
		(6)
		(13 marks)