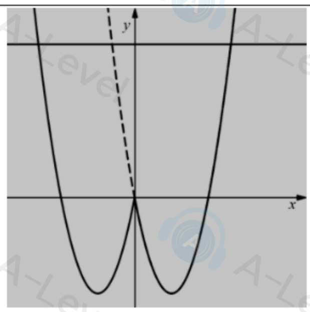
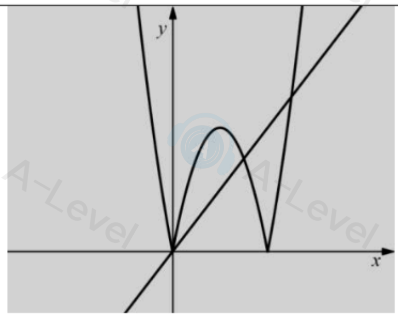
3 (a)	 $y = 48$ Graphical interpretation of $\mathrm{f}\left(\lvert x \rvert\right) = 48$	
	One of $8, -8$	B1
	Attempts to solve an appropriate equation E.g. $2x^2 - 10x = 48 \Rightarrow x^2 - 5x - 24 = 0 \Rightarrow (x \pm 8)(x \pm 3) = 0 \Rightarrow x = \ldots$	M1
	$x = 8, -8$ with no additional values	A1
		(3)
(b)	 $y = \frac{5}{2}x$ Graphical interpretation of $\lvert \mathrm{f}(x) \rvert \geqslant \frac{5}{2}x$	
	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 $x \leqslant \frac{15}{4}$ or $x \geqslant \frac{25}{4}$	A1
		(4)

10(a)(i)	$(y =) 10 + k$	B1
(ii)	$x = \frac{10}{k}$ **or** $y = k$	B1
	$x = \frac{10}{k}$ **and** $y = k$	B1
		(3)

(b)	$kx - 10 + k = 2k \Rightarrow x = \ldots$ **or** $-kx + 10 + k = 2k \Rightarrow x = \ldots$	M1
	$kx - 10 + k = 2k \Rightarrow x = \ldots$ **and** $-kx + 10 + k = 2k \Rightarrow x = \ldots$	dM1
	$x \leqslant \frac{10-k}{k}$ or $x \geqslant \frac{10+k}{k}$ oe	A1
		(3)

(c)	$k > 3$	B1
	Maximum value of k occurs when $y = 3x + 1$ passes through vertex e.g. when $"k" = 3 \times "\frac{10}{k}" + 1 \Rightarrow k = \ldots$ **See below for alternative approaches.**	M1
	$k^2 - k - 30 = 0 \Rightarrow (k+5)(k-6) = 0 \Rightarrow k = 6$ So **maximum** k is 6	A1
	$3 < k < 6$	A1
		(4)
		Total 10

Question Number	Scheme	Marks
1(a)	$(-2, -3)$	B1
		(1)
(b)	$(-3, -9)$	B1B1
		(2)
(c)	$(-4, 3)$	B1
		(1)
		(4 marks)

Question Number	Scheme	Marks
1(a)	$\mathrm{gf}(1) = \mathrm{g}\left(\frac{2(1)}{3\times1+1}\right) = 4 - \left(\frac{2(1)}{3\times1+1}\right)^2$	M1
	$= \frac{15}{4}$ oe	A1
		(2)
(b)	$\mathrm{f}(x) \ldots 0$ or $\mathrm{f}(x) < \frac{2}{3}$	B1
	$0 \,„\, \mathrm{f}(x) < \frac{2}{3}$	B1
		(2)
(c)	$y = \frac{2x}{3x+1} \Rightarrow 3xy + y = 2x \Rightarrow 3xy - 2x = -y \Rightarrow x(3y-2) = -y$ or $x = \frac{2y}{3y+1} \Rightarrow 3xy + x = 2y \Rightarrow 3xy - 2y = -x \Rightarrow y(3x-2) = -x$	M1
	$\Rightarrow \mathrm{f}^{-1}(x) = \frac{x}{2-3x}$	A1
		(2)
(d)	$\mathrm{f}^{-1}(x) = \mathrm{f}(x)$ **or** $\mathrm{f}^{-1}(x) = x$ **or** $\mathrm{f}(x) = x$ $"\frac{x}{2-3x}" = \frac{2x}{3x+1}$ **or** $"\frac{x}{2-3x}" = x$ **or** $\frac{2x}{3x+1} = x$ $\Rightarrow x(3x+1) = 2x(2-3x)$ **or** $x = x(2-3x)$ **or** $2x = x(3x+1)$ $\Rightarrow x = \ldots$	M1
	$x = 0, \frac{1}{3}$	A1
		(2)
		Total 8

6 (a)	$y=\frac{4x+3}{x-2} \Rightarrow yx-2y=4x+3 \Rightarrow yx-4x=2y+3$ | $y=4+\frac{11}{x-2} \Rightarrow y-4=\frac{11}{x-2}$, $x-2=\frac{11}{y-4}$	M1
	$\Rightarrow x=\frac{2y+3}{y-4} \Rightarrow \mathrm{f}^{-1}(x)=\frac{2x+3}{x-4}$ | $\Rightarrow x=2+\frac{11}{y-4} \Rightarrow \mathrm{f}^{-1}(x)=2+\frac{11}{x-4}$	A1
	$x \neq 4$	B1
		(3)
(b)	$\mathrm{ff}(x)=\frac{4\times\frac{4x+3}{x-2}+3}{\frac{4x+3}{x-2}-2}$ or $\mathrm{ff}(x)=4+\frac{11}{4+\frac{11}{x-2}-2}$	M1
	$=\frac{4\times(4x+3)+3(x-2)}{4x+3-2(x-2)}=\frac{19x+6}{2x+7}$	dM1 A1
		(3)
(c)	Either $x=1$ or $y=38$	M1
	(1, 38)	A1
		(2)
		(8 marks)

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