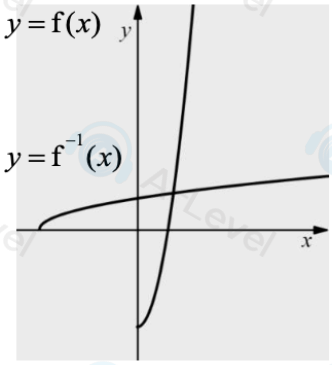
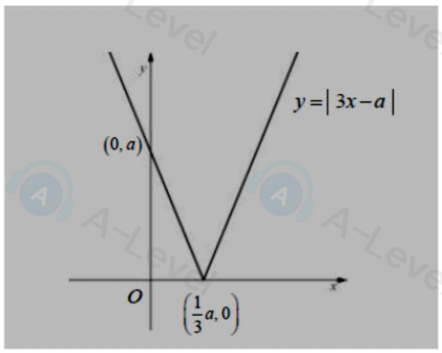
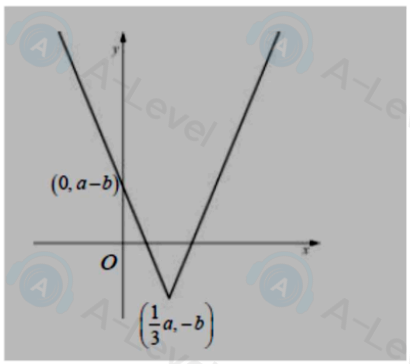
4.(a)	$f \geqslant -5$	B1 **(1)**
(b)	 Curve starting on negative x-axis and passing through positive y-axis, in quadrants 1 and 2 only. Shape and position correct.	M1 A1 **(2)**
(c)	$2x^2 - 5 = x$ or $2x^2 - 5 = \sqrt{\frac{x+5}{2}}$ or $x = \sqrt{\frac{x+5}{2}}$ or $2\left(2x^2-5\right)^2 - 5 = x$ 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**

Question Number	Scheme	Marks
1 (a)	$(2, -4)$	B1, B1 **(2)**
(b)	$(8, 6)$	B1, B1 **(2)**
(c)	$(-2, 6)$	B1 **(1)**
		(5 marks)

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

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

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
	$x \,„\, \frac{10-k}{k}$ or $x \ldots \frac{10+k}{k}$ oe	A1
		(3)

(c)	$k > 3$	B1
	Maximum value of k occurs when $y = 3x + 1$ passes through vertex e.g. when $"k" = 3\times"\frac{10}{k}"+1 \Rightarrow k = ...$ **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

8(a)	$\tan 3x \equiv \tan(2x+x) \equiv \frac{\tan 2x + \tan x}{1 - \tan 2x \tan x}$ or e.g. $\tan 3x \equiv \frac{\sin 3x}{\cos 3x} \equiv \frac{\sin(2x+x)}{\cos(2x+x)} \equiv \frac{\sin 2x\cos x + \cos 2x \sin x}{\cos 2x \cos x - \sin 2x \sin x} \equiv \frac{\tan 2x + \tan x}{1 - \tan 2x \tan x}$	M1
	$\frac{\tan 2x + \tan x}{1 - \tan 2x \tan x} \equiv \frac{\frac{2\tan x}{1-\tan^2 x} + \tan x}{1 - \frac{2\tan x}{1-\tan^2 x}\tan x}$	dM1
	$\frac{\frac{2\tan x}{1-\tan^2 x} + \tan x}{1 - \frac{2\tan x}{1-\tan^2 x}\tan x} \equiv \frac{2\tan x + \tan x - \tan^3 x}{1 - \tan^2 x - 2\tan^2 x}$ $\frac{3\tan x - \tan^3 x}{1 - 3\tan^2 x}$ *	A1*
		(3)

(b)	$\frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2\theta} = 2\sec^2 3\theta - 8 \Rightarrow \tan 3\theta = 2\sec^2 3\theta - 8$ $\Rightarrow \tan 3\theta = 2(1 + \tan^2 3\theta) - 8$	M1
	$\Rightarrow 2\tan^2 3\theta - \tan 3\theta - 6 = 0$ or e.g. $\Rightarrow 2\tan^2 3\theta - \tan 3\theta = 6$	A1
	$(2\tan 3\theta + 3)(\tan 3\theta - 2) = 0 \Rightarrow \tan 3\theta = -\frac{3}{2}, 2$ $\tan 3\theta = -\frac{3}{2} \Rightarrow 3\theta = ... \Rightarrow \theta = ...$ or $\tan 3\theta = 2 \Rightarrow 3\theta = ... \Rightarrow \theta = ...$	dM1
	$\theta = 0.37, 0.72, 1.42$	A1A1
		(5)
		Total 8