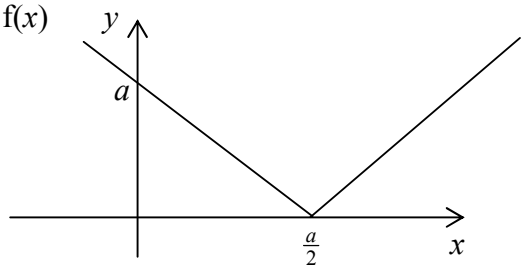
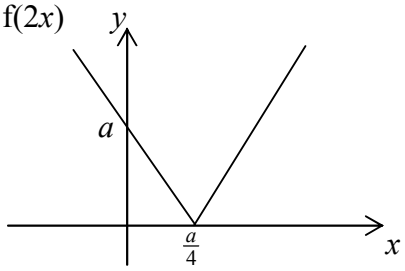
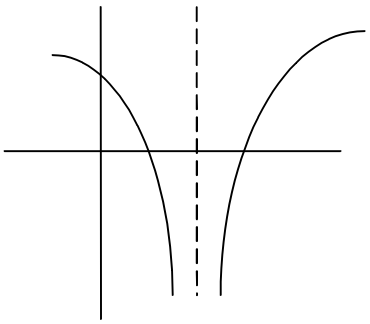
Question Number	Scheme	Marks
1.	$\frac{(x-3)(x-5)}{(x-3)(x+3)} \times \frac{2x(x+3)}{(x-5)^2}$ (3 × factorising) $= \frac{2x}{x-5}$	B1 B1 B1 B1 **(4 marks)**
2. (*a*)	$f(x) = x + \ln 2x - 4$; $x_{n+1} = 4 - \ln 2x_n$, $x_0 = 2.4$ $x_1 = 2.431\ldots$ A single sound application of $x_2 = 2.418\ldots$ iteration $x_3 = 2.423\ldots$ At least x_3 reached Root = 2.422 (A2) 2.42 or "correct" unrounded to 3 d.p. answer A1	M1 M1 A2, 1, 0 (4)
(*b*)	Choosing an appropriate interval e.g. [2.4215, 2.4225] Establishing change of sign + Conclusion	M1 A1 (2) **(6 marks)**
3. (*a*)	$y = f(x)$  Fairly even $\vee$, vertex on +ve x axis Only $(\frac{a}{2}, 0)$ and $(0, a)$ on graph on text	B1 B1 (2)
(*b*)	$y = f(2x)$  Steeper, even $\vee$ and 1 correct intersection Only both $(\frac{a}{4}, 0)$ and $(0, a)$ on graph or in text	B1 [ft $\frac{a}{2}$ from (*a*)] B1 (2)
(*c*)	$-(2x - a) = \frac{1}{2}x$ when $x = 4$, $\Rightarrow a - 8 = 2$ $\therefore a = 10$ $2x - a = \frac{1}{2}x$ when $x = 4$, $\Rightarrow 8 - a = 2$ $\therefore a = 6$	M1, A1 M1, A1 (4) **(8 marks)**

Question Number	Scheme	Marks
4.	$\dfrac{1-\tan^2\theta}{1+\tan^2\theta} = \dfrac{1-\dfrac{\sin^2\theta}{\cos^2\theta}}{1+\dfrac{\sin^2\theta}{\cos^2\theta}}$ $\left(\text{or } \dfrac{1-\dfrac{\sin^2\theta}{\cos^2\theta}}{\sec^2\theta} \text{ or equivalent}\right)$ $\dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta+\sin^2\theta} = \dfrac{\cos 2\theta}{1} = \cos 2\theta$ *	M1 M1 M1 A1 (4) **(4 marks)**
5.	$\dfrac{3}{x(x+2)} + \dfrac{x-4}{(x+2)(x-2)}$ $= \dfrac{3(x-2)+x(x-4)}{x(x+2)(x-2)}$ $= \dfrac{(x-3)(x+2)}{x(x+2)(x-2)}$	B1 B1 M1 A1 M1 A1 A1 **(7 marks)**
6. (*a*)	f″(x) = $2x - 2x^{-3}$ $= 8 - \dfrac{6}{24} = 7\dfrac{31}{32}$ (7.97)	M1 A1 A1 (3)
(*b*)	f(x) = $\dfrac{1}{3}x^3 - 2x - \dfrac{1}{x}$ (+C) $0 = 9 - 6 - \dfrac{1}{3} + C$ $\quad C = -\dfrac{8}{3}$ (or –2.67)	M1 A1 M1 A1 (4)
(*c*)	f′(x) > 0 needed, or f′(x) ≥ 0, or "as x increases, f(x) increases" f′(x) = $(x - \dfrac{1}{x})^2$, > 0 always, or ≥ 0 always	B1 M1, A1 (3) **(10 marks)**

Question Number	Scheme		Marks
7. (*a*)	$f(x) = \frac{2(2x+1)-6}{(x-1)(2x+1)}, = \frac{4x-4}{(x-1)(2x-1)}$	(M for attempt same denominator)	M1, A1
	i.e $f(x) = \frac{4(x-1)}{(x-1)(2x-1)}, = \frac{4}{(2x+1)}$ *	(M for factorising)	M1, A1 c.s.o (4)
(*b*)	$0 < f < \frac{4}{3}$ or $0 < y < \frac{4}{3}$	$\alpha < f < \beta$, $\alpha = 0$ or $\beta = \frac{4}{3}$	B1
		Both	B1 (2)
(*c*)	$y = \frac{4}{2x=1}$ $\Rightarrow y\,(2x + 1) = 4$		M1
	i.e $x = \frac{4-y}{2y}$		M1
	$\therefore f^{-1}(x) = \frac{4-x}{2x}$ (o.e)	must be $f^{-1}(x)$	A1 (3)
(*d*)	Range of f^{-1} = domain of f $\therefore f^{-1} > 1$ or $y > 1$ or > 1		B1 (1)
			(10 marks)

Question Number		Scheme	Marks
8.	(*a*)	$y = \ln(3x - 6) \quad \Rightarrow 3x - 6 = e^{y}$	M1
		$\Rightarrow x = \frac{e^{y} + 6}{3}; \qquad \{f^{-1}(x)\} = \frac{e^{x} + 6}{3}$	M1;A1 (3)
	(*b*)	Domain: $x \in \Re$	B1
		Range: $f^{-1}(x) > 2$	B1 (2)
	(*c*)	Attempting to find $f^{-1}(3)$ $[= \frac{e^{3} + 6}{3}]$; $= 8.70$	M1;A1 (2)
	(*d*)	 ln curve passing through $y = 0$	B1
		Symmetry in $x = k$, $k > 0$	M1
		All correct and asymptote at $x = 2$ labelled	A1 (3)
	(*e*)	Meets *y*-axis: $(x = 0)$, $y = \ln 6$	B1
		Meets *x*-axis: $x = \frac{5}{3}$, (0); $x = \frac{7}{3}$, (0)	B1 B1 3)
		[May be seen on graph]	
			(13 marks)