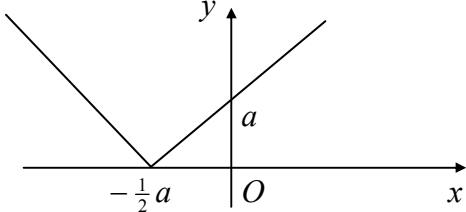
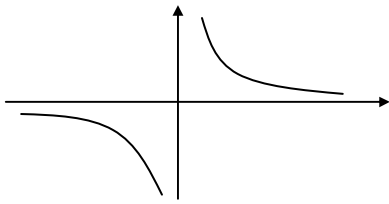
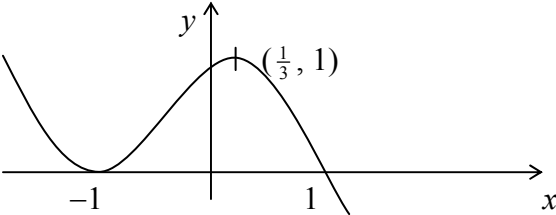
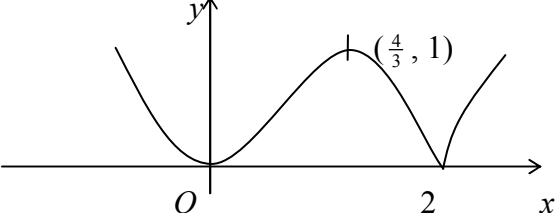
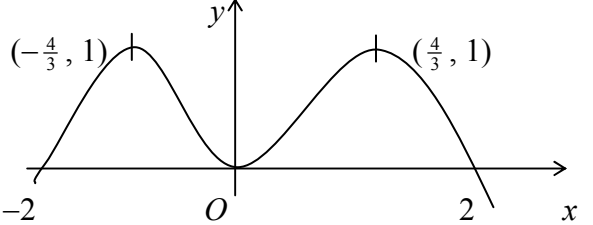
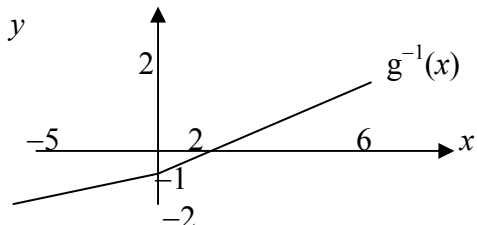
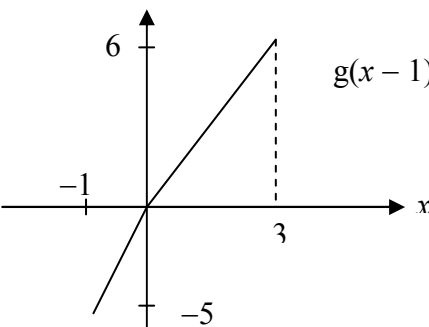
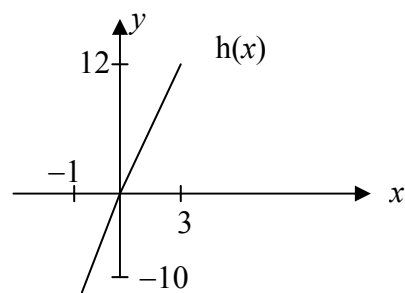
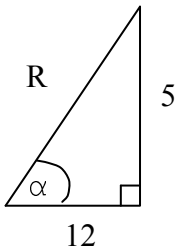


Question Number	Scheme	Marks
1.	(a) $4^x = (2^x)^2 = u^2$ or $2^{(x+1)} = 2 \cdot 2^x = 2u, \rightarrow u^2 - 2u - 15 (=0)$ (b) $u^2 - 2u - 15, = (u-5)(u+3)$ $u = 5 \Rightarrow 2^x = 5 \Rightarrow x = \frac{\log 5}{\log 2}, = 2.32$ [Ignore any other solution]	M1, A1 c.s.o (2) M1, A1 M1, A1 (4) (6 marks)
2.	(a) $f'(x) = 0.5e^x - 2x$ $f'(0) = 0.5$ Equation of tangent at A is: $y = f'(0)x + f(0)$, i.e $y = 0.5x + 0.5$ (b) $f'(x) = 0 \Rightarrow 2x = \frac{1}{2}e^x$ i.e $4x = e^x$ $\Rightarrow x = \ln(4x) \quad *$ (c) $x_1 = \ln 8.6 = 2.1517622$ $x_2 = 2.1525814$ $x_3 = 2.152962... = 2.1530$ (4dp) only	M1 A1 c.s.o M1, A1 (4) M1 M1 A1 c.s.o (3) M1 A1 c.a.o (2) (9 marks)
3.	(a)  (b)  (c) Meet where $\frac{1}{x} = 2x + a \Rightarrow x 2x + a - 1 = 0$; only one meet (d) $2x^2 + x - 1$ Attempt to solve; $x = \frac{1}{2}$ (no other value)	V graph with 'vertex' on x-axis $\{-\frac{1}{2}a, (0)\}$ and $\{(0), a\}$ seen M1 A1 (2) Correct graph (could be separate) B1 (1) B1 (1) B1 M1; A1 (3) (7 marks)

Question Number	Scheme	Marks
4. (a)	 Translation in $\leftarrow$ or $\rightarrow$ Points correct	B1 B2, 1, 0 (-1 eeo) (3)
(b)	 $x < 2$ including points $x > 2$ correct reflection cusp at (2, 0) (not $\cup$)	B1 B1 B1 (3)
(c)	 correct shape $x \geq 0$ symmetry in y-axis correct maxima correct x intercepts	B1 B1 B1 B1 (4) (10 marks)
5. (i)	A correct form of $\cos 2x$ used $1 - 2\left(\frac{3}{5}\right)^2 \text{ or } \left(\frac{4}{5}\right)^2 - \left(\frac{3}{5}\right)^2 \text{ or } 2\left(\frac{4}{5}\right)^2 - 1 \quad \left\{ \frac{7}{25} \right\}$ $\sec 2x = \frac{1}{\cos 2x} \quad ; \quad = \frac{25}{7} \text{ or } 3\frac{4}{7}$	M1 A1 M1A1 (4)
(ii)	(a) $\frac{\cos 2x}{\sin 2x} + \frac{1}{\sin 2x}$ or (b) $\frac{1}{\tan 2x} + \frac{1}{\sin 2x}$ Forming single fraction (or multiplying both sides by $\sin 2x$) Use of correct trig. formulae throughout and producing expression in terms of $\sin x$ and $\cos x$ Completion (cso) e.g. $\frac{2\cos^2 x}{2\sin x \cos x} = \frac{\cos x}{\sin x} = \cot x \quad (*)$	M1 M1 M1 A1 (4) (8 marks)

Question Number	Scheme	Marks
6. (a)	$y = \frac{3x-1}{x-3} \Rightarrow y(x-3) = 3x-1$ $yx - 3x = 3y - 1$ $x(y-3) = 3y-1$ $x = \frac{3y-1}{y-3} \therefore f^{-1}(x) = \frac{3x-1}{x-3} = f(x)$	M1 M1 A1 cso (3)
(b)	$ff(k) = f^{-1}f(k) = k$	M1 A1 (2)
(c)	$g(-2) = -5$	B1
	$f(-5) = \frac{-15-1}{-8} = \frac{-16}{-8} = 2$	M1, A1 (3)
(d)		shape B1 (0, -1) and (2, 0) B1 Domain: $-5 \leq x \leq 6$ B1 (3)
(e)		Translation +1 → (lines join at (0,0)) B1
		Stretch $\times 2 \uparrow$ B1 Range: $-10 \leq h(x) \leq 12$ B1 (3)
		(14 marks)

Question Number	Scheme	Marks
7. (a)	$12 \cos \theta - 5 \sin \theta = R \cos \theta \cos \sigma - R \sin \theta \sin \sigma$ $R^2 = 5^2 + 12^2, \Rightarrow R = 13$  $\tan \sigma = \frac{5}{12}, \Rightarrow \sigma = 22.6^\circ \text{ (awrt 22.6)}$ $\text{(AWRT or } 0.39^\circ \text{ (AWRT } 0.39^\circ \text{))}$	M1 A1 M1, A1 (4)
(b)	$\cos (\theta + 22.6) = \frac{4}{13}$ $\theta + 22.6 = 72.1,$ $\theta = 49.5$ (only)	M1 M1 A1 (3)
(ii)	$\frac{8}{\tan \theta} - 3 \tan \theta = 2$ i.e. $0 = 3 \tan^2 \theta + 2 \tan \theta - 8$ $0 = (3 \tan \theta - 4)(\tan \theta + 2)$ $\tan \theta = \frac{4}{3} \text{ or } -2$ $\tan \theta = \frac{4}{3} \Rightarrow \theta = 53.1$ $[\text{ignore } \theta \text{ not in range e.g. } \theta = 116.6]$	M1 M1 M1 A1 A1 (5) (12 marks)

Question Number	Scheme	Marks
8. (a)	$f'(x) = \frac{3}{x} - \frac{1}{x^2}$ $\frac{3}{x} - \frac{1}{x^2} = 0 \Rightarrow 3x^2 - x = 0 \Rightarrow x = \frac{1}{3}$	M1 A1 M1 A1 (4)
(b)	$y = 3 \ln\left(\frac{1}{3}\right) + \frac{1}{\left(\frac{1}{3}\right)} = 3 - 3 \ln 3 \quad (k = 3)$	M1 A1 (2)
(c)	$x = 1 \Rightarrow y = 1$ $f(1) = 2 \Rightarrow m = -\frac{1}{2}$ $y - 1 = -\frac{1}{2}(x - 1) \quad \left(y = -\frac{x}{2} + \frac{3}{2}\right)$	B1 M1 M1 A1 (4)
(d) (i)	$-\frac{x}{2} + \frac{3}{2} = 3 \ln x + \frac{1}{x}$ $\text{leading to } 6 \ln x + x + \frac{2}{x} - 3 = 0 \quad *$	M1 A1 c.s.o
(ii)	$g(0.13) = 0.273 \dots$ $g(0.14) = -0.370 \dots \quad \text{both, except 1 d.p}$ $\text{Sign change (and continuity)} \Rightarrow \text{root} \in (0.13, 0.14)$	M1 A1 (4)
		(14 marks)