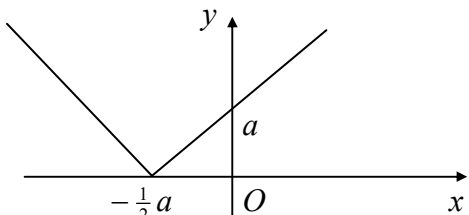
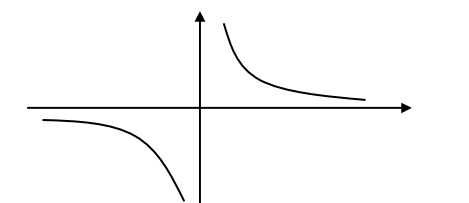
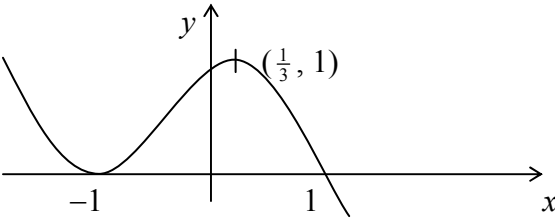
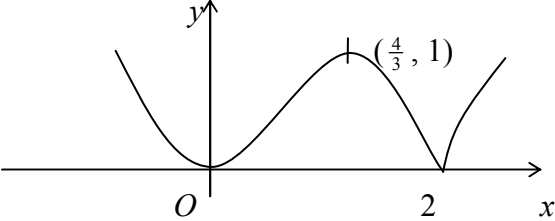
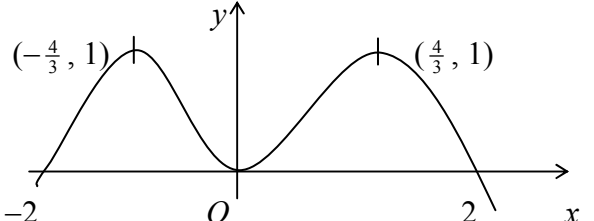
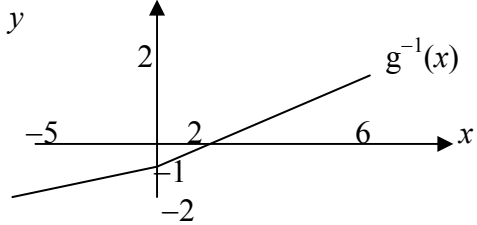
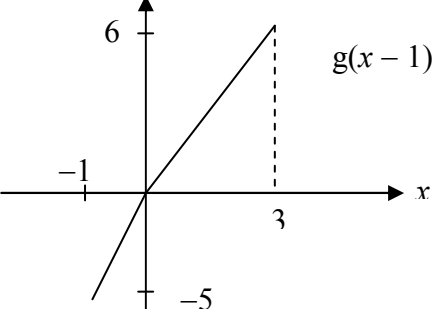
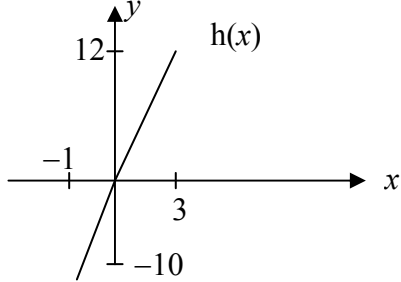
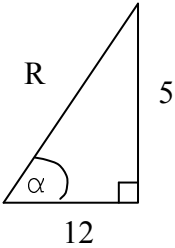


Question Number	Scheme	Marks
1.	<p>(a) $4^x = (2^x)^2 = u^2$ or $2^{(x+1)} = 2 \cdot 2^x = 2u, \rightarrow u^2 - 2u - 15 (=0)$</p> <p>(b) $u^2 - 2u - 15, = (u - 5)(u + 3)$</p> <p>$u = 5 \Rightarrow 2^x = 5 \Rightarrow x = \frac{\log 5}{\log 2}, = 2.32$</p> <p>[Ignore any other solution]</p>	<p>M1, A1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

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

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 (0, -1) and (2, 0) Domain: $-5 \leq x \leq 6$
(e)		Translation +1 → (lines join at (0,0))
		Stretch $\times 2 \uparrow$ Range: $-10 \leq h(x) \leq 12$
		(14 marks)

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

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