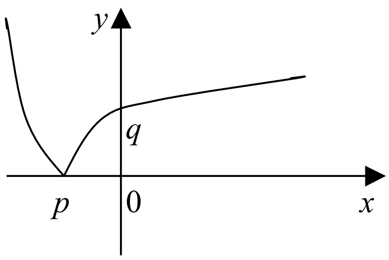
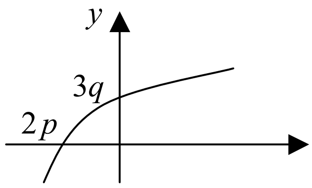
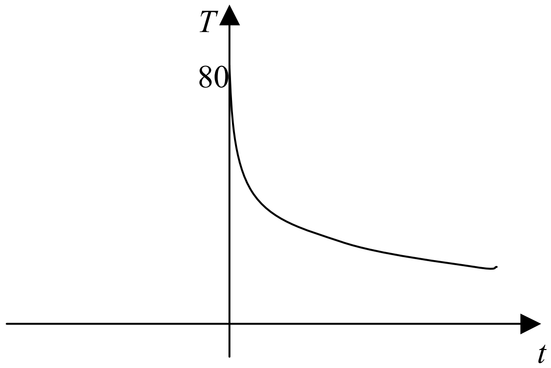
Question number	Scheme	Marks
1. (a)	$\lvert x-2\rvert - 3 = 1$ $\quad x = 6$	B1
	$-(x-2) - 3 = 1 \Rightarrow x = -2$	M1 A1 (3)
(b)	$g(x) = x^2 - 4x + 11 = (x-2)^2 + 7$ or $g'(x) = 2x - 4$	M1 A1
	$g'(x) = 0 \Rightarrow x = 2$	
	Range: $g(x) \geq 7$.	A1 (3)
(c)	$gf(-1) = g(0)$ correct order; $= 11$	M1 A1 (2)
		(8 marks)
2. (a)	$f(2) = 8 - 4 - 5 = -1$ method shows change of sign	M1
	$f(3) = 27 - 6 - 5 = 16$ $\Rightarrow$ root with accuracy	A1 (2)
(b)	$x_1 = 2.121$, $x_2 = 2.087$, $x_3 = 2.097$, $x_4 = 2.094$	M1 A2 (1, 0) (3)
(c)	Choosing suitable interval, e.g. [2.09455, 2.09465]	M1
	$f(2.09455) = -0.00001\ldots$ shows change of sign	M1
	$f(2.09465) = +0.001(099..)$ accuracy and conclusion	A1 (3)
		(8 marks)
3. (a)	$\cos(A+B) = \cos A \cos B - \sin A \sin B$ (formula sheet)	
	$\cos(\frac{1}{2}\theta + \frac{1}{2}\theta)$ $= \cos(\frac{1}{2}\theta)\cos(\frac{1}{2}\theta) - \sin(\frac{1}{2}\theta)\sin(\frac{1}{2}\theta) = \cos^2(\frac{1}{2}\theta) - \sin^2(\frac{1}{2}\theta)$	M1
	$= \{1 - \sin^2(\frac{1}{2}\theta)\} - \sin^2(\frac{1}{2}\theta) = 1 - 2\sin^2(\frac{1}{2}\theta)$	M1 A1 (3)
(b)	$\sin\theta + 1 - \cos\theta = 2\sin(\frac{1}{2}\theta)\cos(\frac{1}{2}\theta) + 2\sin^2(\frac{1}{2}\theta)$	M1 M1
	$= 2\sin(\frac{1}{2}\theta)[\cos(\frac{1}{2}\theta) + \sin(\frac{1}{2}\theta)]$	A1 (3)
	[M1 use of $\sin 2A = 2\sin A\cos A$; M1 use of (a)]	
(c)	$2\sin(\frac{1}{2}\theta)[\cos(\frac{1}{2}\theta) + \sin(\frac{1}{2}\theta)] = 0$	
	$\Rightarrow \sin(\frac{1}{2}\theta) = 0$ or $\cos(\frac{1}{2}\theta) + \sin(\frac{1}{2}\theta) = 0$	M1
	$\theta = 0$	B1
	$\tan\frac{1}{2}\theta = -1$; $\Rightarrow \theta = \frac{3}{2}\pi$	M1 A1 (4)
		(10 marks)

Question number	Scheme	Marks
4. (a)	$x^2 + 2x - 3 = (x + 3)(x - 1)$	B1
	$\text{f}(x) = \dfrac{x(x^2+2x-3)+3(x+3)-12}{(x+3)(x-1)}$ $\quad \left[= \dfrac{x^3+2x^2-3}{(x+3)(x-1)}\right]$	M1A1
	$= \dfrac{(x-1)(x^2+3x+3)}{(x-1)(x+3)}$	M1
	$= \dfrac{(x^2+3x+3)}{(x+3)}$	A1 (5)
(b)	$\text{f}'(x) = \dfrac{(x+3)(2x+3)-(x^2+3x+3)}{(x+3)^2}$ $\quad \left[= \dfrac{x^2+6x+6}{(x+3)^2}\right]$	M1 A2, 1, 0
	Setting $\text{f}'(x) = \frac{22}{25}$ and attempting to solve quadratic	M1
	$x = 2$ (only this solution)	A1 (5)
		(10 marks)
ALT (b)	ALT: $\text{f}(x) = x + \dfrac{3}{x+3}$, $\text{f}'(x) = 1 - \dfrac{3}{(x+3)^2}$	

Question number	Scheme		Marks	
5. (a)	(i) 	Shape correct:	B1	
		Intercepts	B1	(2)
	(ii) 	Shape correct	B1	
		$(2p, 0)$ on x	B1	
		$(0, 3q)$ on y	B1	(3)
(b)	q = 3 ln 3		B1	(1)
(c)	$\ln(2p+3) = 0 \Rightarrow 2p + 3 = 1$; $\quad p = -1$		M1 A1	(2)
(d)	$\frac{dy}{dx} = \frac{6}{2x+3}$; evaluated at $x = p$ (6)		M1 A1	
	Equation: $y = 6(x + 1)$ any form		M1 A1ft	(4)
				(12 marks)

Question number	Scheme	Marks
6. (a)	$T = 80$	B1 (1)
(b)	$e^{-0.1t} \geq 0$ or equivalent	B1 (1)
(c)	 Negative exponential shape	M1
	$t \geq 0$, "80" clearly not $\to$ x-axis	A1 (2)
(d)	$60 = 20 + 60\,e^{-0.1t} \Rightarrow 60\,e^{-0.1t} = 40$	M1
	$\Rightarrow -0.1\,t = \ln\left(\frac{2}{3}\right)$	M1A1
	$t = 4.1$	A1 (4)
(e)	$\frac{dT}{dt} = -6\,e^{-0.1t}$	M1A1 (2)
(f)	Using $\frac{dT}{dt} = -1.8$	B1
	Solving for t, or using value of $e^{-0.1t}$ (0.3)	M1
	$T = 38$	A1 (3)
		(13 marks)

Question number	Scheme	Marks
7. (i)	$\frac{dy}{dx} = \sec^2 x - 2\sin x$	B1 B1
	When $x = \frac{1}{4}\pi$, $\frac{dy}{dx} = 2 - \sqrt{2}$	B1 (3)
(ii)	$\frac{dx}{dy} = \frac{1}{2}\sec^2 \frac{1}{2}y$	B1
	$\frac{dy}{dx} = \frac{2}{\sec^2\left(\frac{y}{2}\right)} = \frac{2}{1+\tan^2\left(\frac{y}{2}\right)} = \frac{2}{1+x^2}$	M1 M1 A1 (4)
(iii)	$\frac{dy}{dx} = 2e^{-x}\cos 2x - e^{-x}\sin 2x = e^{-x}(2\cos 2x - \sin 2x)$	M1 A1 A1
	Method for R: R = 2.24 (allow $\sqrt{5}$)	M1 A1
	Method for α: $\alpha = 0.464$	M1 A1 (7)
		(14 marks)