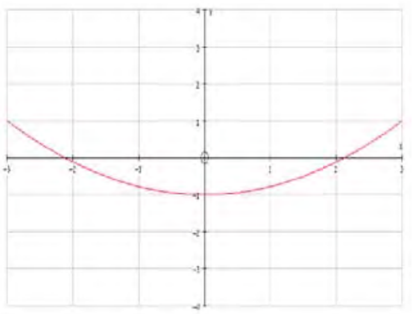
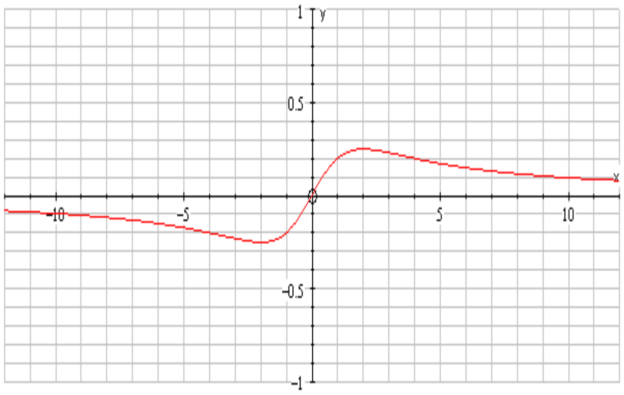
Question Number	Scheme	Marks
1. (*a*)	$\dfrac{3(x+1)}{(x+2)(x-1)} \equiv \dfrac{A}{x+2} + \dfrac{B}{x-1}$, and correct method for finding *A* or *B*	M1
	$A = 1, \quad B = 2$	A1 A1 (3)
(*b*)	$\text{f}'(x) = -\dfrac{1}{(x+2)^2} - \dfrac{2}{(x-1)^2}$	M1 A1
	Argument for negative, including statement that square terms are positive for all values of *x*. (f.t. on wrong values of *A* and *B*)	A1 ft (3)
		(6 marks)
2. (*a*)	Attempt to use correctly stated double angle formula $\cos 2t = 2\cos^2 t - 1$, or complete method using other double angle formula for cos2*t* with $\cos^2 t + \sin^2 t = 1$ to eliminate *t* and obtain $y =$	M1
	$y = 2(\tfrac{x}{3})^2 - 1$ or any correct equivalent (even $y = \cos 2(\cos^{-1}(\tfrac{x}{3}))$)	A1 (2)
(*b*)	 shape	B1
	position including restricted domain $-3 < x < 3$	B1 (2)
		(4 marks)
3.	$\displaystyle\int \frac{\cos\theta}{\cos^3\theta}\,d\theta, = \int \sec^2\theta \;\; d\theta$	M1 A1, M1
	$= \tan\,\theta\;(+\,c)$	B1
	$= \dfrac{\sin\theta}{\cos\theta}\;(+c) = \dfrac{x}{\sqrt{(1-x^2)}}\;(+\,c)\;\;(*)$	M1 A1
		(6 marks)
4.	Estimate for $M^2 = \dfrac{0.25}{2}[(48^2 + 29^2) + 2(207^2 + 37^2 + 161^2)]$	M1 B1 M1
	Evaluating this estimate to 17 900 (awrt)	M1 A1
	$M \approx 134$ (133.9), (130)	A1
		(6 marks)

Question Number	Scheme	Marks
5.	Volume = $\pi\int_1^4\left(1+\frac{1}{2\sqrt{x}}\right)^2 dx$	M1
	$\int\left(1+\frac{1}{2\sqrt{x}}\right)^2 dx = \int\left(1+\frac{1}{\sqrt{x}}+\frac{1}{4x}\right) dx$	B1
	$=\left[x+2\sqrt{x}+\frac{1}{4}\ln x\right]$	M1 A1 A1ft
	Using limits correctly	M1
	Volume = $\pi\left[\left(8+\frac{1}{4}\ln 4\right)+3\right]$	A1
	$=\pi\left[5+\frac{1}{2}\ln 2\right]$	A1
		(8 marks)
6. (*a*)	$\frac{dV}{dt}=30-\frac{2}{15}V$	M1 A1
	$\Rightarrow -15\frac{dV}{dt}=-450+2V$, (*) no wrong working seen	A1 (3)
(*b*)	Separating the variables $\Rightarrow$ $-\frac{15}{2V-450}dV=dt$	M1
	Integrating to obtain $-\frac{15}{2}\ln\lvert 2V-450\rvert=t$ OR $-\frac{15}{2}\ln\lvert V-225\rvert=t$	M1 A1
	Using limits correctly or finding c $(-\frac{15}{2}\ln 1550$ *OR* $-\frac{15}{2}\ln 775)$	M1
	$\ln\frac{2V-450}{1550}=-\frac{2}{15}t$, or equivalent	A1
	Rearranging to give $V=225+775e^{-\frac{2}{15}t}$.	M1A1 (7)
(*c*)	V = 225	B1 (1)
		(11 marks)

Question Number	Scheme	Marks
7. (*a*)	$\frac{dy}{dx} = \frac{(4+x^2) - x(2x)}{(4+x^2)^2}$ or (from product rule) $(4+x^2)^{-1} - 2x^2(4+x^2)^{-2}$	M1 A1
	Solve $\frac{\text{dy}}{\text{dx}} = 0$ to obtain (2, ¼) , and (–2, –¼) [(2 and –2) only = A1]	M1 A1 A1 (5)
(*b*)	When $x = 2$, $\frac{d^2y}{dx^2} = -0.0625 < 0$, thus maximum	B1 M1
	When $x = -2$, $\frac{d^2y}{dx^2} = 0.0625 > 0$, thus minimum	B1 (3)
(*c*)	 Shape for $-2 \le x \le 2$	B1
	Shape for $x > 2$	B1
	Shape for $x < 2$	B1 (3)
		(11 marks)
8. (i)	$\cos x \cos 30 - \sin x \sin 30 = 3(\cos x \cos 30 + \sin x \sin 30)$ Use of $\cos(x \pm 30)$	M1
	$\Rightarrow \sqrt{3}\cos x - \sin x = 3\sqrt{3}\cos x + 3\sin x$ Sub. for sin 30 etc decimals M1, surds A1	M1, A1
	i.e. $-4\sin x = 2\sqrt{3}\cos x \rightarrow \tan x = -\frac{\sqrt{3}}{2}$ (*) Use $\tan x = \frac{\sin x}{\cos x}$	M1, A1cso (5)
(ii) (*a*)	LHS $= \frac{1-(1-2\sin^2\theta)}{2\sin\theta\cos\theta}$ Use of cos 2*A* or sin 2*A*; both correct	M1; A1
	$= \frac{\sin\theta}{\cos\theta} = \tan\theta$ (*)	A1 cso (3)
(*b*)	Verifying: $0 = 2 - 2$ (since sin 360 = 0, cos 360 = 1)	B1 cso (1)
(*c*)	Equation $\rightarrow$ $1 = \frac{2(1-\cos 2\theta)}{\sin 2\theta}$ Rearrange to form $\frac{1-\cos 2\theta}{\sin 2\theta}$	M1
	$\Rightarrow \tan\theta = \frac{1}{2}$	A1
	i.e. $\theta = 26.6°$ or $206.6°$ (Accept 27°, 207°)	M1 A1 (4)
		(13 marks)

Question Number	Scheme	Marks
9. (*a*)	Any two of $1+\lambda=-2+2\mu$, $3+2\lambda=3+\mu$, $5-\lambda=-4+4\mu$	M1
	Solve simultaneous equations to obtain μ = 2, **or** λ = 1	M1 A1
	Lines intersect at (2 , 5 , 4)	M1 A1
	Check in the third equation or on second line	B1 (6)
(*b*)	$1\times2+2\times1+(-1)\times4=0$ line perpendicular	M1 A1 (2)
(*c*)	*P* is the point (3, 7, 3) [i.e. $\underline{\lambda}$ = 2] and *R* is the point (4, 6, 8) [i.e. μ = 3]	M1 A1
	$PQ=\sqrt{1^2+2^2+(-1)^2}=\sqrt{6}$ $RQ=\sqrt{2^2+1^2+4^2}=\sqrt{21}$ $PR=\sqrt{27}$	M1 A1 ft
	The area of the triangle = $\frac{1}{2}\times\sqrt{6}\times\sqrt{21}=\frac{3\sqrt{14}}{2}$	M1 A1 (6)
		(14 marks)