Question			Answer	Marks	AO	Guidance	
4	(a)		**DR** $f\left(\frac{1}{2}\right)=6\left(\frac{1}{2}\right)^3+k\left(\frac{1}{2}\right)^2+57\left(\frac{1}{2}\right)-20$ $\frac{3}{4}+\frac{k}{4}+\frac{57}{2}-20=0\Rightarrow k=-37$	**M1** **A1** **[2]**	**1.1** **2.2a**	Substitutes $x=\pm0.5$ into f(x) **AG -** $f\left(\frac{1}{2}\right)=0$ and at least one line of intermediate working before given answer	Allow one slip Long division in this part is no marks
4	(b)		**DR** $f(x)=6x^3-37x^2+57x-20$ $\Rightarrow f(x)=(2x-1)(3x^2+kx+20)$ $f(x)=(2x-1)(3x^2-17x+20)$ $=(2x-1)(3x-5)(x-4)$	**M1** **A1** **A1** **[3]**	**1.1** **1.1** **1.1**	Quadratic factor found with correct coefficient of x^2 and constant term (or second correct root found from factor theorem) Or second factor stated correctly	Or from long division : $3x^2$ and an x term at least for M1
4	(c)	(i)	**DR** $e^{-t}=\frac{1}{2},\frac{5}{3},4$ $t=-\ln\left(\frac{1}{2}\right),-\ln\left(\frac{5}{3}\right),-\ln 4$	**M1*** **A1** **[2]**	**3.1a** **1.1**	Correctly relates e^{-t} to at least one of the roots of $f(x)=0$ Correctly takes logs and obtains correct values of t	 Any equivalent form Allow 3sf or better
4	(c)	(ii)	**DR** $\sum t=-\left(\ln\left(\frac{1}{2}\right)+\ln\left(\frac{5}{3}\right)+\ln 4\right)=-\ln\left(\frac{5\times4}{2\times3}\right)$ $=\ln\left(\frac{3}{10}\right)$ or $-\ln\left(\frac{10}{3}\right)$	**M1dep*** **A1** **[2]**	**2.1** **2.2a**	Correctly uses logs law to add their three values of t together cao	Dependent on **M** mark in part **(i)**