Question Number	Scheme	Marks
10	$\frac{\mathrm{d}V}{\mathrm{d}t} = 40$ (cm^3/s)	B1
	$A = 4\pi r^2 \quad \frac{\mathrm{d}A}{\mathrm{d}r} = 8\pi r$	M1A1
	$V = \frac{4}{3}\pi r^3 \quad \frac{\mathrm{d}V}{\mathrm{d}r} = 4\pi r^2$	M1A1
	$\frac{\mathrm{d}A}{\mathrm{d}t} = \frac{\mathrm{d}A}{\mathrm{d}r} \times \frac{\mathrm{d}r}{\mathrm{d}V} \times \frac{\mathrm{d}V}{\mathrm{d}t}, = 8\pi r \times \frac{1}{4\pi r^2} \times 40 \quad (= \frac{80}{r})$	M1,A1ft
	$r = 4$ so $\frac{80}{4} = 20$ $(\mathrm{cm}^2/\mathrm{s})$	dM1A1cao **[9]**
	Any letters can be used for volume and area, inc *SA* for area, but their choice must be used consistently.	
B1	State or use $\frac{\mathrm{d}V}{\mathrm{d}t} = 40$ (cm^3/s) (units not needed)	
M1	Attempt to differentiate $4\pi r^2$ with respect to r (Formula for area of sphere is given on formula page)	
A1	Correct derivative = d*A*/d*t*	
M1	Attempt to differentiate $\frac{4}{3}\pi r^3$ with respect to r (Formula for volume of sphere is given on formula page)	
A1	Correct derivative = d*A*/d*t*	
M1	Show (or use) a useful chain rule. Terms can be in any order as long as it is possible to obtain d*A*/d*t* from it. OR Use chain rule twice to obtain an expression from which d*A*/d*t* could be obtained.	
A1ft	Substitute their expressions for the 3 derivatives in their chain rule. Need not be simplified.	
dM1	Use the resulting expression(s) with $r = 4$ to obtain a value for d*A*/d*t* All previous M marks needed.	
A1cao +cso	Correct value, units may be missing. Solution must be correct.	

Question Number	Scheme	Marks
11(a)	$(3\sin A\cos B - 3\cos A\sin B) = (\sin A\cos B + \cos A\sin B)$	M1
	$2\sin A\cos B = 4\cos A\sin B$	M1
	$\rightarrow \dfrac{\sin A}{\cos A} = 2\dfrac{\sin B}{\cos B}$	M1
	$\tan A = 2\tan B \quad k = 2$	A1 (4)
(b)	$\dfrac{(\cos^4\theta - \sin^4\theta)}{\cos^2\theta} = \dfrac{(\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)}{\cos^2\theta}$	M1
	$= \dfrac{(\cos^2\theta - \sin^2\theta)}{\cos^2\theta}$	M1
	$= 1 - \tan^2\theta$ *	A1 cso (3)
ALT 1	$1-\tan^2\theta = 1-\dfrac{\sin^2\theta}{\cos^2\theta} = \dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}$	M1
	$= \dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}\times\left(\cos^2\theta+\sin^2\theta\right)$	M1
	$= \dfrac{\cos^4\theta-\sin^4\theta}{\cos^2\theta}$	A1
ALT 2	$\dfrac{\cos^4\theta-\sin^4\theta}{\cos^2\theta} = \cos^2\theta - \dfrac{\sin^4\theta}{\cos^2\theta} = \cos^2\theta - \tan^2\theta\sin^2\theta$	M1 Eliminate 4^{th} powers
	$= \cos^2\theta - \tan^2\theta\left(1-\cos^2\theta\right)$	M1 Eliminate $\sin^2$
	$= \cos^2\theta - \tan^2\theta + \sin^2\theta = 1-\tan^2\theta$	A1
(c)(i)	$\cos(45-30)$ or $\cos(60-45) = \dfrac{1}{2}\times\dfrac{\sqrt{2}}{2}+\dfrac{\sqrt{3}}{2}\times\dfrac{\sqrt{2}}{2}$	M1
	$= \frac{\sqrt{2}}{4}+\frac{\sqrt{6}}{4} = \frac{\sqrt{2}+\sqrt{6}}{4}$ *	A1cso (2)
ALT	By using double angle formula: $\cos^2 15° = \dfrac{1}{2}(1+\cos 30°) = \dfrac{1}{2}\left(1+\dfrac{\sqrt{3}}{2}\right)$	M1
	Leading to the *given* answer. $\cos 15° = \sqrt{\left(\dfrac{2+\sqrt{3}}{4}\right)}$ or $\dfrac{\sqrt{2+\sqrt{3}}}{2}$ must be seen.	A1

Question Number	Scheme	Marks
(ii)	$\tan 255 = \tan 75$	B1
	$= \tan(30+45) = \dfrac{\tan 30 + \tan 45}{1 - \tan 30 \tan 45}$	M1
	$= \dfrac{\frac{\sqrt{3}}{3}+1}{1-\frac{\sqrt{3}}{3}}$	dM1
	$\dfrac{\frac{3+\sqrt{3}}{3}}{\frac{3-\sqrt{3}}{3}} = \dfrac{3+\sqrt{3}}{3-\sqrt{3}}$ *	A1cso (4)
		[13]
(a)		
M1	Expand both sides of the equation using correct formulae	
M1	Collect like terms from their expansions. (Not dependent)	
M1	Divide through by $\cos A \cos B$	
A1	Replace each fraction with the appropriate tangent and show $k = 2$ (value need not be shown explicitly)	
(b)		
M1	Factorise the numerator using the difference of 2 squares.	
M1	Replace $\sin^2\theta + \cos^2\theta$ with 1	
A1cso	Divide both terms by $\cos^2\theta$ and obtain the *given* answer with no errors seen.	
ALT 1		
M1	Use $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ and obtain a single fraction with no tan	
M1	Indicate multiplication by $\sin^2\theta + \cos^2\theta$	
A1cso	Multiply and obtain the *given* answer with no errors seen.	
(c)(i)		
M1	Express 15 as the difference of 2 suitable numbers, expand using a correct formula and substitute the correct exact values for the trig functions (substitution must be shown).	
A1cso	Simplify and combine the fractions to obtain the *given* answer with no errors seen.	
(ii)		
B1	$\tan 255 = \tan 75$ seen explicitly or used. OR eg tan(210 + 45) – give B1 for tan 210 = tan 30 used	
M1	Express 75 as 30 + 45 and expand $\tan(30+45)$ using the correct formula (given on the formula page) OR expand tan (210 + 45) If 75 = 15 + 60 is used tan 15 can be obtained from a calculator but must be in exact form..	
dM1	Substitute the correct exact values for the trig functions	
A1cso	Simplify the fractions to obtain the *given* answer with full working and no errors seen.	