

Question			Answer	Marks	AO	Guidance	
12	(a)		$\frac{2+4x}{x(1+x)(1-x)} = \frac{A}{x} + \frac{B}{1+x} + \frac{C}{1-x}$	B1	3.1a	Identify correct partial fractions	From using their 3 distinct linear factors Possibly implied by $A = 2$ etc
			$A(1+x)(1-x) + Bx(1-x) + Cx(1+x) = 2+4x$	M1	1.1	Clear fractions and attempt (at least) one coefficient	
			$A = 2, B = 1, C = 3$	A1	1.1	Obtain one correct value www	
			$\frac{2+4x}{x(1-x^2)} = \frac{2}{x} + \frac{1}{1+x} + \frac{3}{1-x}$	A1	2.1	Obtain fully correct partial fractions	
				[4]			

Question			Answer	Marks	AO	Guidance	
12	(b)		$\int \tan y dy = \int \frac{2+4x}{x(1+x)(1-x)} dx$	M1*	3.1a	Attempt to separate variables to obtain $\int f(y)dy = \int g(x)dx$	Condone no integral signs BOD if no dx and/or dy or still present as a single operator
			$\int \left(\frac{2}{x} + \frac{1}{1+x} + \frac{3}{1-x} \right) dx =$ $2 \ln x + \ln 1+x - 3 \ln 1-x \quad (+ c)$	B1FT	2.1	Correct integration of their 3 linear partial fractions from part (a) B0 if any y term still on RHS	Condone no constant of integration Condone brackets not modulus signs Brackets / modulus could be implied by further working, otherwise B0
			$\int \tan y dy = \ln \sec y $	B1	3.1a	Correct integration of tany B0 if any x term on LHS, or if tany is still in term on RHS	$\ln \sec y $ or $-\ln \cos y $
			$\ln \sec y = \ln \frac{kx^2(1+x)}{(1-x)^3}$ $\sec y = \frac{kx^2(1+x)}{(1-x)^3}$ or $\cos y = \frac{(1-x)^3}{kx^2(1+x)}$	M1dep*	3.1a	Correct process to combine all terms and remove logs Must deal correctly with indices and correctly use rules for combining logs	Must include constant of integration (could be e^c rather than k). but could be numerical already (possibly incorrect)
				A1FT	2.1	Obtain a correct equation no longer involving logs FT on an incorrect numerical constant of integration only NB $(x-1)^3$ not $(1-x)^3$ is A0	All algebraic terms must be fully correct (no FT on these)
			$\sqrt{2} = \frac{\frac{1}{4} \times \frac{3}{2} k}{\frac{1}{8}}, \frac{1}{2} \sqrt{2} = \frac{\frac{1}{8}}{\frac{1}{4} \times \frac{3}{2} \times k}$ so $k = \frac{1}{3} \sqrt{2}$	M1dep*	1.1	Use $(\frac{1}{2}, \frac{1}{4} \pi)$ in a correct equation to attempt to find k	Could be awarded before combining terms
			$\cos y = \frac{3\sqrt{2}(1-x)^3}{2x^2(1+x)}$	A1	2.1	Obtain fully correct equation, in required form	Surd may not be rationalised, but no fractions within fractions
				[7]			