

16		$u = 1 + \sqrt{x}$	B1	3.1a	for use in substitution	No marks for attempts based solely on integration by parts
		$\frac{du}{dx} = \frac{1}{2}x^{-\frac{1}{2}}$	M1	1.1	allow M1 for $x^{-\frac{1}{2}}$	
		$\sqrt{x} = u - 1$	M1	1.1	allow sign error	
		$\int \frac{(u-1)^2 \times 2(u-1)}{u} du$	A1	3.1a	du may be seen later	
		$\frac{2(u^3 - 3u^2 + 3u - 1)}{u}$ soi	M1	2.1	allow sign errors and/or omission of 2	
		$2 \left[\frac{u^3}{3} - \frac{3u^2}{2} + 3u - \ln u \right]$	M1	3.1a	divides their cubic through by u and integrates dependent on award of first two M marks; allow sign errors and coefficient errors	must have $\ln u$
		$\frac{2(1+\sqrt{x})^3}{3} - 3(1+\sqrt{x})^2 + 6(1+\sqrt{x}) - 2\ln(1+\sqrt{x})$ +c oe isw	A1	1.1		
			A1	3.2a	if answer fully correct but either + c or du not seen then withhold final A1	
			[8]			

Question			Answer	Marks	AOs	Guidance	
			<i>Alternative</i> $x = u^2$	B1		<i>or</i> $u = \sqrt{x}$	may see $u = \frac{1}{1+\sqrt{x}}$ <i>or</i> $e^u = (1+)\sqrt{x}$
			$\frac{dx}{du} = 2u$	M1		allow M1 for $\frac{du}{dx} = x^{-\frac{1}{2}}$	
			$\sqrt{x} = u$	M1		$x = u^2$	
			$\int \frac{u^2 \times 2u}{1+u} du$	A1			
			$(2u^2 - 2u + 2) - \frac{2}{1+u}$ from long division oe	M1		allow sign errors and/or omission of 2	
			$\frac{2u^3}{3} - u^2 + 2 - 2\ln(1+u)$	M1 A1		integration attempted; allow sign errors and coefficient errors	
			$\frac{2x\sqrt{x}}{3} - x + 2\sqrt{x} - 2\ln(1+\sqrt{x}) + c$	A1		if answer fully correct but either $+c$ or du not seen then withhold final A1	
				[8]			