STEP II, 2020, Q1 MS

	Only penalise missing +c once in parts (i) and (ii)
1(i)	$\int \frac{1}{x^{\frac{3}{2}}(x-1)^{\frac{1}{2}}}\,dx = \int \frac{(1-u)^2}{u^{\frac{1}{2}}} \frac{1}{(1-u)^2}\,du$ Must include attempt at $\frac{du}{dx}$ (or $\frac{dx}{du}$)
	$= 2u^{\frac{1}{2}}$
	$= 2\left(\frac{x-1}{x}\right)^{\frac{1}{2}} + c$
1(ii)	Let $x - 2 = s$
	Then $\int \frac{1}{(x-2)^{\frac{3}{2}}(x+1)^{\frac{1}{2}}}\,dx = \int \frac{1}{s^{\frac{3}{2}}(s+3)^{\frac{1}{2}}}\,ds$
	Let $s = \frac{3}{u-1}$
	$\int \frac{1}{s^{\frac{3}{2}}(s+3)^{\frac{1}{2}}}\,ds = \int \frac{(u-1)^2}{3^2 u^{\frac{1}{2}}} \frac{-3}{(u-1)^2}\,du = -\frac{2}{3}u^{\frac{1}{2}}$
	$= -\frac{2}{3}\left(\frac{s+3}{s}\right)^{\frac{1}{2}} = -\frac{2}{3}\left(\frac{x+1}{x-2}\right)^{\frac{1}{2}} + c$
1(iii)	Let $x = \frac{1+u}{u}$ Allow substitution leading to two algebraic factors in the denominator.
	$\int_2^{\infty} \frac{1}{(x-1)(x-2)^{\frac{1}{2}}(3x-2)^{\frac{1}{2}}}\,dx = \int_1^0 \frac{u^2}{(1-u)^{\frac{1}{2}}(3+u)^{\frac{1}{2}}} \cdot \left(\frac{-1}{u^2}\right)du$ If done through a sequence of substitutions: a further substitution leading to a square root of a quadratic as the denominator.
	$= \int_0^1 \frac{1}{\left(3-2u-u^2\right)^{\frac{1}{2}}}\,du$

	$= \int_0^1 \frac{1}{\left(4-(1+u)^2\right)^{\frac{1}{2}}} \, \mathrm{d}u$
	$= \left[\arcsin\left(\frac{1+u}{2}\right)\right]_0^1$
	$= \frac{1}{2}\pi - \frac{1}{6}\pi = \frac{1}{3}\pi$