

STEP II, 2020, Q1

- 1 (i) Use the substitution $x = \frac{1}{1-u}$, where $0 < u < 1$, to find in terms of x the integral

$$\int \frac{1}{x^{\frac{3}{2}}(x-1)^{\frac{1}{2}}} dx \quad (\text{where } x > 1).$$

- (ii) Find in terms of x the integral

$$\int \frac{1}{(x-2)^{\frac{3}{2}}(x+1)^{\frac{1}{2}}} dx \quad (\text{where } x > 2).$$

- (iii) Show that

$$\int_2^{\infty} \frac{1}{(x-1)(x-2)^{\frac{1}{2}}(3x-2)^{\frac{1}{2}}} dx = \frac{1}{3}\pi.$$



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