

STEP III, 2014, Q2

- 2 (i) Show, by means of the substitution $u = \cosh x$, that

$$\int \frac{\sinh x}{\cosh 2x} dx = \frac{1}{2\sqrt{2}} \ln \left| \frac{\sqrt{2} \cosh x - 1}{\sqrt{2} \cosh x + 1} \right| + C.$$

- (ii) Use a similar substitution to find an expression for

$$\int \frac{\cosh x}{\cosh 2x} dx.$$

- (iii) Using parts (i) and (ii) above, show that

$$\int_0^1 \frac{1}{1+u^4} du = \frac{\pi + 2 \ln(\sqrt{2} + 1)}{4\sqrt{2}}.$$



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