

STEP III, 2010 Q2

2 In this question, a is a positive constant.

(i) Express $\cosh a$ in terms of exponentials.

By using partial fractions, prove that

$$\int_0^1 \frac{1}{x^2 + 2x \cosh a + 1} dx = \frac{a}{2 \sinh a}.$$

(ii) Find, expressing your answers in terms of hyperbolic functions,

$$\int_1^\infty \frac{1}{x^2 + 2x \sinh a - 1} dx$$

and

$$\int_0^\infty \frac{1}{x^4 + 2x^2 \cosh a + 1} dx.$$



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