

STEP II, 2012, Q3 EC

Q3 This was another popular question, scoring just over half of the marks on average. Although most efforts to establish the given initial result were eventually successful, many made hard work of it, failing to notice the obvious result that if $t = \sqrt{x^2 + 1} + x$ then $\frac{1}{t} = \sqrt{x^2 + 1} - x$.

The first integral could then be found by realising that $f(t) = \frac{1}{t^2}$ was the relevant function here, or by repeating the substitution already used.

Quite a few candidates thought that the second integral followed from the first, which was unfortunate, as it didn't. However, most efforts at this second integral were unsuccessful anyhow, with candidates usually getting 3 of the 10 marks for setting up the substitution and then often going round in circles. The main problem lay in using sin and cos instead of tan and sec, or

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in continuing with $\sqrt{x^2 + 1} + x$ without identifying a suitable function $f(t)$. It was helpful to find this, but not essential.



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