

## STEP II, 2019, Q2 EC

This question was another popular question that was generally well answered, achieving the second-best average mark of all of the questions and was also the question for which the largest number of solutions received full marks. Most candidates drew a convincing sketch to demonstrate that the two integrals make a rectangle. Arguments from sketches showing the inverse function and reflective symmetry were less successful and often candidates' diagrams assumed  $x$  to be a fixed point of  $f(t)$ .

By far the most common mistake in the first part was to notice the solution  $g(2) = 1$  but not to factorise and use the quadratic discriminant to show that no other solutions were possible. The conceptually difficult part was to use  $g^{-1}(y) = y^3 + y$ , and many candidates stopped just before this point.

In the final part, many candidates tried to apply the stem identity in its original form, without noticing that  $h(0) \neq 0$ . This was the most difficult part, and those who modified it correctly generally did well. Candidates sometimes failed to check that  $h'(t) > 0$ , but this was not necessary for those who used  $h(t) = g(t + 2)$ .



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