

STEP II, 2020, Q8 EC

For the first part candidates were asked to sketch a curve $y = F(x)$ based on some information about the function $f(x)$. A not insignificant number of candidates instead sketched $y = f(x)$ but those who sketched the correct curve often earned most of the marks. When justifying the given form of $F(x)$ some good explanations were provided, but in many cases the repeated roots at $x = 0$ and $x = c$ were not explained. The final section of part (i) was generally completed well by those who reached it.

The next part was found to be more difficult with many candidates mistakenly using the local maximum of $F(x)$ at $x = b$ to justify the first inequality instead of the local minimum at $x = a$. It was common to see justification such as $|F(x)| < F(b)$ without showing first that $F(b) = -F(a)$. Candidates who spotted the connection with part (i) and substituted $x = b$ into their expression for $F(x) + F(c - x)$ were usually able to show $c - b = a$ or $c > 2h$. For the last section of part (ii), those who realised the connection with the first paragraph had no issues.

Candidates who reached the final part of the question were often able to obtain expression for $f(x)$ and most realised that they needed to calculate $f''(x)$ in order to find the inflection points. However, the final mark for spotting that the roots of $f''(x) = 0$ are necessarily roots of $f(x) = 0$ without explicitly calculating them (and thereby wasting time) eluded the majority of candidates who reached this part.



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