

## STEP II, 2009, Q4 EC

**Q4** Considering the very poor marks gained on this question, it was surprisingly popular, with almost 600 “hits”. Its essential difficulty lay in the fact that one can only go so far in this question before requiring the ‘*key of insight*’ in order to progress further. And that was that, as they say. Personally, this was my favourite question, as the *key* is such a simple one once it is pointed out to you (clearly not an option in the exam., of course). Parts (i) and (ii) require candidates to find  $p(1) = 1$  and to show that  $p'(x)$  has  $(x - 1)^4$  as a factor, and most did so perfectly satisfactorily. The (strikingly similar) information then given in (iii) **should** then suggest (surely?), to anyone with any sort of nous, that they are required to make similar further deductions. Nope – apparently not. Even amongst the few who *did* then find  $p(-1) = -1$  and show that  $p'(x)$  has  $(x + 1)^4$  as a factor, very few knew what to do with these facts. I think that this is principally because most students work “on automatic” in examinations – a by-product of the much (and rightly) criticised modular system – simply doing as they are told at each little step of the way without ever having to stand back, even momentarily, and take stock of the situation before planning their own way forwards. This is the principal shame with modular assessment: the system prevents the very able from ever having to prove their ability whilst simultaneously persuading the only modestly able that they are fantastic mathematicians when they aren’t. A moment of thoughtful reflection on the nature of this strange creature that is  $p(x)$  and what we now know about it reveals all. It is a polynomial of degree 9. Its derivative **must** therefore be a polynomial of degree 8. And we know that  $p'(x)$  has two completely distinct factors of degree 4. Apart from the tendency to assume that a polynomial always commences with a coefficient of 1, the rest (in principle) is just a matter of adding two 4s to get 8.



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