STEP Mathematics III 2009: Report

The vast majority of candidates (in excess of 95%) attempted at least five questions, and nearly a quarter attempted more than six questions, though very few doing so achieved high scores (about 2%). Most attempting more than six questions were submitting fragmentary answers, which, as the rubric informed candidates, earned little credit.

Section A: Pure Mathematics

1. A popular question attempted by more than four fifths of the candidates, and scoring as well as any question, and most successfully obtained expressions for p and q. Quite a lot also obtained the quadratic equation and from it the sum and product of roots for s and t. However, a common error at this stage was to overlook the coefficient of the second degree term not being 1. For this reason, or otherwise, because they didn't know what to do many "fell at the last hurdle", although a good number completed the question successfully.

2. This was similar to question 1 in popularity and success. Virtually all got part (i) correct, and many used the series correctly to obtain the value for a_1. Quite a few completed the question, although frequently candidates dropped 2 marks through not looking at terms properly.

3. Though slightly more popular than the first 2 questions, the attempts scored marginally less well. Candidates began well, though the limit of f '(t) was not well done. The even function in (ii) was usually correctly justified. Part (iii) was frequently not quite correctly justified, though some did so by sketching $y = e^{-t}$ and $y = 1 - t$. The sketch of f(t) often had the wrong gradient as it approached the y axis, and asymptotes were frequently not identified.

4. About half the candidates attempted this, with similar levels of success to question 3. Parts (i) and (iii) caused few problems though part (ii) did. There were some errors in part (iv), but it was the last part using the four results that usually went wrong.

5. This was the most popular question, with a few more attempts than question 3, but with a level of success matching the first two questions. Many showed the first two results correctly, and quite a few the third one. The last part tripped up many candidates, though the most successful used the first approach in the mark scheme. A number of candidates understood "independent of n" in the question to be given information, and attempted to find a, b, and c by solving three simultaneous equations for specific values of n. However, there were commonly errors in the values of the S_n used. An efficient alternative solution is given in the mark scheme.

6. About a third of the candidates attempted this, though with less success than any of its predecessors. Attempts were mostly "all or nothing". Some candidates thought that the cyclic quadrilateral property had to be that opposite angles are supplementary, as the only property that they knew.

7. Approximately two thirds of the candidates attempted this, earning roughly half marks in doing so. Part (i) and finding the three expressions for P_0, P_1 & P_2 from part (ii) largely went well. The result involving P_{n+1} saw most falling by the wayside, especially those who attempted it by induction. Quite a few candidates did score all but two marks in proving that P_n was a polynomial of degree n or less, but not appreciating that there was still something to do regarding the leading term.

8. Roughly the same number attempted this as question 7, with slightly less success. Usually, a candidate did not properly obtain the first three results, and so would end up having apparently finished the whole question but in fact scoring only two thirds marks. The problem was often that the limiting process was not fully understood. In part (ii), there was often odd splitting going on to attempt the integration by parts and this part often went wrong.

Section B: Mechanics

9. The most popular of the three Mechanics questions, being attempted by a sixth of the candidates, it was also the least successful, scoring only a quarter of the marks. Quite a few candidates scored nothing at all, and quite a few got the result in part (i) correctly, although by a variety of approaches, given that the uniform acceleration equations can be combined in numerous ways. However, few made any headway with the trajectory equation for part (ii).

10. The second least popular question on the paper attempted by a twelfth of the entry, the success rate on it was comparable to questions 7 and 8. Mostly, candidates successfully found and solved the differential equation, but finding T stumped them, with a alternative approaches successfully used in a very small number of cases.

11. A little less popular than question 9, the success rate was between those of the other questions in this section. Candidates tended to polarize scoring less than a third of, or very nearly all if not all of the marks. Conservation of energy, uniform acceleration and even constant speed were erroneous methods attempted. Even some good candidates carried out the integration in part (i), and then failed to solve the quadratic equation for x.

Section C: Probability and Statistics

12. About a tenth of the candidates attempted this, usually earning quarter marks. Quite often the conditional bit in part (i) threw them, so they were 3 marks down before they got into the question. 80% of the attempts did not obtain or use the pgf as required. A small number of candidates really knew their stuff and did it very well.

13. A handful of candidates attempted this question with a couple making a good stab at part (i), but otherwise it was the odd crumb, if even that, which was collected.