Admissions Testing Service

STEP Examiners' Report 2016

Mathematics

STEP 9465/9470/9475

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STEP II 2016 REPORT

General Comments

As in previous years the Pure questions were the most popular of the paper with questions 1, 3 and 7 the most popular of these. The least popular questions of the paper were questions 10, 11, 12 and 13 with fewer than 400 attempts for each of them. There were many examples of solutions in this paper that were insufficiently well explained, given that the answer to be reached had been provided in the question.

Comments on individual questions

Question 1
This was a popular question and many very good solutions were seen. The first part of the question was a relatively straightforward application of differentiation and parametric equations and was successfully completed by many of the candidates. The sketches produced were generally the correct shape for the parabola, although in some cases it was not in the correct position. The other curve caused more problems with some candidates drawing another parabola or similar shape.

Question 2
This question received poor responses in terms of the average mark per attempt. Application of the factor theorem to the first part often produced a neat solution. However, a number of candidates in the first part did not use the factor theorem as requested and so produced very complicated algebraic expressions that were more of a challenge to simplify. Where the result had been successfully shown and the expression factorised, many candidates were able to see the relevance to solving the equation in part (i). Those candidates who were able to follow through the method to successfully factorise the second expression were often able to complete the question.

Question 3
This was the most popular question on the paper, and candidates generally scored well here. The first two parts were relatively straightforward and were answered well. The final part required careful explanation from candidates and many were not able to take the initial step of rewriting the relationship between the function and its derivative in a useful way. Those who did successfully complete this part were often able to identify the number of roots in each of the two cases.

Question 4
This question attracted many good responses which often successfully accomplished the first and third results of part (i) of the question, although in many cases marks were lost through incomplete explanations of some of the steps taken. Part (ii) of the question was generally answered poorly with some candidates simply stating that the square root of one expression in terms of surds was equal to the other one that they had achieved. Only a small number of candidates successfully completed the last section of this question.

Question 5
This was the least attempted of all of the Pure questions and one that generally produced low marks for candidates, who generally appeared to have difficulty in expressing the coefficients of the binomial expansion in the required form. In each case the desired answer was given in the question, and so successful solutions also needed to be very clear about the reasoning used to reach the answer.

Question 6
This question was answered relatively poorly compared to the others, as many candidates did not appear to read the question carefully enough and so attempted to solve the differential equations in parts (i) and (ii) rather than simply verifying the results given. Where candidates moved on to parts (iii) and (iv) they were generally successful if they were able to complete the differentiation of the new function.

Question 7
This was the second most popular and one of the best-answered questions on the paper, with many candidates scoring very high marks. In many cases the initial result was explained clearly and then applied successfully to the first example. Candidates were generally able to follow through the calculations where they were able to see the way in which the result could be achieved, and so most of the attempts that followed a correct method only lost marks through occasional errors in calculation.

Question 8
The first task in this question was generally well answered, although sketches were often unclear or difficult to interpret. In part (i) many candidates were able to obtain the first approximation, but then could not see how to achieve the other two, often offering sums of a non-integer number of terms which gives the correct approximation when substituted into the formula. Those who successfully completed part (i) were often able to approximate the error in part (ii) and see how it applies to the final sum.

Question 9
This question was the most popular of the mechanics questions, and many candidates were able to complete the first part of the question successfully. In many cases this was as far as they got, as a large number of candidates were unable to make significant progress on part (ii). Where candidates were able to identify a correct strategy for solving the problem they were often successful in reaching expressions, only losing marks through errors in the algebra.

Question 10
This question received a number of very good, and often concise, answers. However, there was a significant number of candidates who did not calculate the centre of mass, or mistakenly assumed that the formula for the centre of mass for an equilateral triangle could be applied. Many candidates chose to consider the limiting case first and then deduce the inequality in the final step, but did not justify the direction of the inequality clearly. There were a number of cases where the required angles where not calculated correctly when resolving the forces.

Question 11

Although not a popular question, this was one of the better-answered questions in terms of the average number of marks achieved per candidate. Many candidates who attempted this question were able to gain many of the marks for part (i), often by substituting $\tan\theta$ for $\frac{b}{a}$ into the simultaneous equations and then eliminating t. Some candidates, however, lost some marks for assuming that $a = \cos\theta$ and $b = \sin\theta$. Part (ii) was well answered by many candidates, but very few solutions successfully explained the link between the two parts of the question.

Question 12

The first part of the question required the proof to follow from the result quoted in the question. For this reason, solutions that explained the result by drawing a Venn diagram were not awarded full marks. In many cases, sets needed to be more clearly defined (for example $A \cap B \cup C$). This was again an example of a question with a given answer where many candidates did not fully explain all of the steps in the proof. The result for the union of four sets was generally well answered, although there were several answers in which not all of the pairwise intersections were identified.

Many candidates were able to calculate the probabilities required in parts (i), (ii) and (iii), but few were able to apply the results from the start of the question to the final calculations.

Question 13

This question received only a small number of attempts, with a significant number of candidates not identifying that a rectangle could be used to approximate the area in each of the cases and so unable to make much progress on the question. The average mark per candidate for this question was the lowest on the paper, with a significant number of attempts not progressing beyond the first step.