9475 - Mathematics III

General comments

Candidates found the paper in general hard. Nevertheless they seemed aware of the importance of depth and quality of answers rather than disposed to do lots of bits. There were disproportionately small numbers of attempts on applied questions, particularly as regards the statistics section. Questions 1 and 7 were very popular. It is pleasing to see that there is a core of candidates who are well up to the challenge and who produce pleasing solutions, and many others who make sustained attempts to rise to it.

Comments of individual questions

1 Many candidates attempted algebraic approaches to the later parts instead of relating the problems to the graph.

2 This question required sustained and confident technical ability. Level of completion reflected the levels of those abilities. The last part required a more subtle appreciation of how integration by substitution works than is usual.

3 This question required a repeated and systematic use of trigonometric identities and their derivation together with the technique of equating coefficients. It tested the ability of candidates to work in a systematic and accurate fashion.

4 This question started with the use of function notation together with an appreciation of the chain rule. This would be unfamiliar to many candidates but at the same time accessible to those who had understood the chain rule well. The later parts required confident use of function notation in a creative way.

5 There were many different approaches to this question; the key to their acceptability is the extent to which they can be justified as sufficiently general. It is clearly not acceptable to illustrate the result with one or more special cases only. It was also important to note the "if and only if" phrase in the question. Those who managed to reach beyond the first proof produced different approaches to the second part, particularly with a preference for the algebraic approach.

6 The lack of structure in this question meant that there were again varied approaches. The solution required some degree of confidence at interrelating elementary geometry with calculus in the less familiar context of polar coordinates. Note that the question requires a solution which starts with a geometrical property and finishes with a parabola, and not the other way.

7 This was a very popular question, with many examples of sustained and correct work. The solution was ambiguous at every stage with a heavy premium on balancing the options with the appropriate correct choice at each stage. It tested candidates robustness very well.

8 This question was only accessible to those who were able to take seriously the required justification in terms of the rules given at each stage of the solution. The last part can be approached in several different variations of the same idea, and did require a careful

construction of an inductive proof from the several elements of the first part. Again it was a test of sustained thought.

9 The first part depends on the intuition that potential energy must be constant if the system is in equilibrium in all positions. The remainder of the question can be attempted without that by assuming the established result, but it makes its return in the complementary intuition that kinetic energy must also be constant by the conservation law.

10 This question is reasonably routine to those candidates who are conversant with standard rigid body results and are confident with integration..

11 The first part requires two separate equations of motion to establish the acceleration of the connected parts; this is standard work. The second extends the usual situation to take in impulsive tensions. The "given" assumption can be justified but is provided as a hint.

12 This question requires the build up of a suitable model with appropriate approximation. This has to be followed through by converting a discrete sum into an approximate integral.

13 This question is another with no structuring. It requires an analysis that breaks the problem into separate parts, which must be recombined at the end.

14 This was a long but straightforward question for those who could handle their definitions with confidence.