STEP III 2001 Comments

Question 1

A reasonably gentle question to start. There are not really any traps to fall into, just a careful algebraic process to follow for the induction and then applying this to find the Maclaurin series.

Question 2

Some meaty integration! Integrals of the form $\sqrt{x^2 \pm a^2}$ should hopefully be within the standard repertoire of candidates but certainly require quite a bit of work to get them out. Lots of care is needed here to ensure nothing is lost along the way!

Question 3

A reasonably accessibly question, I think. Certainly the first part shouldn't cause too much trouble, although care is needed to prove "if and only if" rather than just one direction or the other. The second part is a little trickier, but it is more of the same method.

Question 4

I find questions like this, involving the domain and range of inverse trigonometric functions, really fiddly, and this is no exception. The first part is not bad but after that it gets rather tricky.

Question 5

This is a reasonable question. The first part needs a little bit of careful treatment but is reasonably straightforward. The rest is just working through the algebra, although care is needed to think about what is a variable and what is a constant at each stage.

Question 6

A neat result, in the end, but I think quite a tricky question! I did it using algebra for one part and pure geometry for the other, and both seemed to work out OK. But it took me a lot of attempts to get methods which worked!

Question 7

Gentler than the previous question! The first part is quite standard graph sketching, and solving the differential equation is routine. A little thought is then needed to find a differential equation solved by the curve which is perpendicular to the initial family of solutions; but once written down it is also easy to solve. The final sketch does require some thought.

Question 8

A reasonable question on loci in the Argand diagram. There are multiple ways to work through, including some fairly lengthy algebraic methods; but some though allows you to reduce the amount of work required.

Question 9

The first challenge is interpreting the situation in the question! Once that is done, setting up the equation of motion is not too bad. Solving it requires a decent amount of accurate algebra but it all falls out quite neatly in the end.

Question 10

This feels like quite a "pure" question for the mechanics section, and relatively short, too. Each case just follows from expanding and simplifying the relevant dot products.

Question 11

A relatively short question. The first part of the question (once you have interpreted the description!) requires conservation of energy. After that it is an application of differentiation and the t-formulae.

Question 12

This trick to evaluate the series has come up a few times. I think it's quite a tough sum to evaluate if you haven't seen it before.

Question 13

Quite easy for STEP III, I think. The first part of the question makes sure you understand the premise; the rest is just setting up and solving the various simultaneous equations. B vs C and D vs A can also be done this way, but is quicker to do logically.

Question 14

If you are comfortable with continuous random variable this question isn't too bad. The last bit involves a diagram; but if you have seen questions of this type before it shouldn't be too strenuous.