STEP I 1997 Comments

Question 1

I don't really like this one. You need to be careful and systematic to count all the possibilities, but I don't think there's a particularly interesting underlying structure.

Question 2

Pretty straightforward and doable, with no major stumbling blocks. The only bit that isn't just working through the algebra is using the fact that the derivative is zero to establish that the function is constant, and then substituting in a sensible value to find out its value.

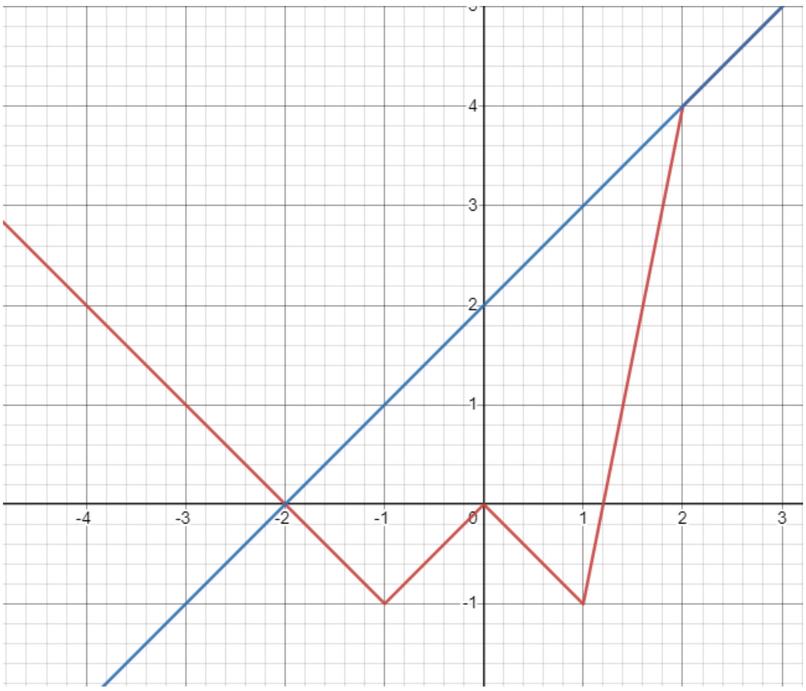
Question 3

Another short question. Some work to do in (ii), but once you take logs things do simplify. In fact $a_7 \approx 6.63 \times 10^{347}$ (thanks WolframAlpha!)

Question 4

I liked this one. It rewards carefully and methodically working through the different possibilities for which modulus functions are positive and which are negative. It's important to check that the solutions for each range are actually within each range.

The graph looks like this.



Question 5

This took me three attempts, each one taking a double page A4 spread to work through! The first time I worked through with everything in the form $\overrightarrow{AB}$, the second time in terms of coordinate geometry, until I eventually got it out on the third attempt. That said, it's a neat result – quantities that are constant are always interesting.

Question 6

I like this question! It's well structured, leading you through the question but leaving you to work out the details, and it leads to a neat result. The first bit can be done by a quicker inspection method rather than long division but I think long division is clearer to follow in a solution.

Question 7

Short, but tricky! There's a few different ways into this question, I think, but all of them require some ingenuity – you can't just follow standard methods. It's quite a neat result.

Question 8

This is a nice question, using the derivative of the function to think about its shape and hence whether it has any roots. I think it's perhaps a little bit short – maybe removing the final part and instead adding another problem using the same idea would have been nice.

Question 9

This is more of a geometry problem than a mechanics problem. You need to be careful with the algebra throughout but I don't think there are any particular leaps of intuition that you need to make.

Question 10

As always, a good diagram is useful! After that, resolving horizontally and vertically gives the two equations which you can then use to get the given result in the question, and also to get an expression for the tension. I'm not completely sure what they wanted from the last bit – my method is very informal but I do think it would be quite hard to prove it formally.

Question 11

My first instinct here was to set up a differential equation, which you can do, but then you end up with a pretty ugly non-linear DE. Once you move to conservation of energy instead, it's pretty straightforward, although treating v^2 rather than v as the independent variable is a bit different to usual procedure.

Question 12

I really like that start of this question – finding a solution of a random equation is neat and something that candidates probably haven't seen before. Once you figure out what you're doing, the rest is pretty straightforward, with some application of the central limit theorem at the end. Actually working out the value of K is a bit messy for a non-calculator paper, though!

Question 13

I think the biggest challenge here is parsing the information from the question and turning it into maths. After that, working out the probabilities is fairly straightforward. You could also have done this question using a tree diagram.

Question 14

Quite a short one, with not much too it. If you are confident with continuous random variables then there should be no big problems here.