

STEP II 1996 Comments

Question 1

This is a nice first question. For the first part, you can just do the expansion (making things simpler if you ignore all the terms with power of x greater than 6), but it is quicker to think about what combination of terms will get you x^6 . You can do the second part the same way, but using the hint makes it much quicker!

Question 2

I think with this question, if you can spot that you can use a substitution to turn this into three linear simultaneous equations, then the rest is pretty straightforward. If you can't spot it, then it's pretty much impossible.

Question 3

Quite fiddly – there are lots of options for how to simplify at each stage of the inductions – because as well as the results from the assumption step you can also use the Fibonacci property. I went down a bit of a false path for the first induction before starting again and getting to the desired result.

Question 4

Just one integral to calculate, but quite a few steps to get there. Judicious use of the cos double angle formulae is required throughout, as well as the $R\sin(x+a)$ method. On the trickier side I think, but not unreasonable.

Question 5

This is quite a nice question, combining solving an equation via substitution and also roots of unity. It's fairly short, but both parts of the question require some thought.

Question 6

Number theory questions are always interesting, because it's rarely taught at school (apart from basic prime factorisation at GCSE) and so the question writers have to craft them quite carefully. I liked this one, the difficulty seems fair and it's an interesting topic.

Question 7

This one took me a couple of attempts to go in the right direction. Initially I had one vertex of the square at the origin. This would actually still work but it does make things a bit trickier with the algebra. The requirement in the question to prove the result in both directions would be overlooked by quite a few candidates I imagine.

Question 8

A nice question, and not a method that I had seen before. The crucial insight is using $f''(x)$ to work out $f''(-x)$. After that, everything falls into place. The second part is pretty much identical to the second part, just with a different differential equation to solve.

Question 9

This is a pretty decent question. The geometry is easier than quite a lot of statics questions, and the final cubic is pretty straightforward to show is always positive.

Question 10

The suvat questions can often have lots of algebra so this one wasn't too bad. It took me a while to link the restriction on the value of $\frac{g}{\omega^2 a}$ to the later inequality but once that connection is made the rest was doable.

Question 11

I've always found lift questions difficult, particularly when the lift itself is accelerating! That said, as long as you are careful and methodical, once you have written down the first couple of equations the rest followed reasonably straightforwardly.

Question 12

This is a nice question. If you can spot the trick to find the cumulative distribution function of Y , the rest is fairly straightforward.

Question 13

A nice difficulty curve on this question, which is sometimes hard to find in the probability questions. The first part is reasonably straightforward but the second part less so – I first started by trying to think about the possible locations of the friend after $2k$ minutes but realised this was both complicated and unnecessary! All that matters, like before, is the possible meeting points.

Question 14

After writing down an expression for $E(Y^n)$ there is some algebra to work through to find $E(Y)$ and $E(Y^2)$. The second part of the question is more difficult I think, using the hint and then a binomial expansion to establish the inequality. The final part is pretty standalone and to be honest feels a bit unnecessary.