Feedback on ME10305 Mathematics 2, May/June 2020

This was an exceptional situation because of the coronavirus, so almost everything about this exam was different apart from there being 10 questions. Unlike previous years, where the exam average tended to be close to 70%, this one attained an average of 87.6%, a personal record! The standard deviation was just below 14%. There was only one failure and three students were dangling on 40%. There were a few more in the 40s, 50s and 60s. We also had 50 students in the 80s and 141 in the 90s, but 19 attained 99% and 17 had full marks.

I have to apologise that some questions didn't have quite enough space for the answers.

There is little that I can comment on in terms of workings-out because I asked mainly for the answers only and with a few intermediate results. The overwhelming majority handed in some very tidily-written scripts, something that happens rarely! However, there were a few with copious crossings out — it would have been so nice for these also to have been well laid-out and easy to read! It was great to see some who had typeset in LaTeX — typesetting wasn't essential but that's real class and it will make your final year project reports look superb.

All the question averages are high, so I'll just concentrate mainly on the sort of things that went wrong.

Q1. ODEs. Average: 8.3/10, standard deviation: 2.1.

Part (a). There should have been five 1st order equations, not just the two that corresponded to the equations on the paper.

Part (b). Very good generally.

Part (c). Some left this in the form, $y = \pm(2e^{t^2} - 1)^{1/2}$, whereas the given initial condition meant that the plus option was the correct one. Some also left it in the form, $y^2 = 2e^{t^2} - 1$, which isn't complete for the same reason. The occasional few had t =function of y; a question of the form, "Solve the equation, $dy/dt = \cdots$", generally implies that y as a function of t is sought.

Part (d). The worst-answered part. Sometimes I was offered the correct answer but with a seriously (i.e. not a typo) incorrect integrating factor. Dubious....

Q2. Laplace Transforms. Average: 9.5/10, standard deviation: 1.4.

Part (a) was bookwork, a pointless exercise for an open-book exam, but not everyone managed it!

Part (b). Very very good.

Part (c). The partial fractions was straightforward but the occasional few got muddled with signs.

Q3. Determinants/Gaussian Elimination. Average: 9.6/10, standard deviation: 1.5.

Hardly any errors. When you see the outline solutions, bear in mind that there were quite a few ways to achieve the upper triangular form, so your way may not be the same as the one I used.

Q4. Fourier Series. Average: 7.9/10, standard deviation: 2.3.

Part (a). Almost uniformly perfect.

Part (b). This was a sine series but a few gave me an A_0 term as well — oops! Impressive integrations by parts too.

Part (c). Some people used $(4 - n^3\pi^3)$ as the extra term in the denominator. Should have been $(4 - n^2\pi^2)$ because the ODE is of second order.

Part (d). A huge variety of different answers were given, from "just the one" to "all of them". It should have been the first three.

Q5. Least Squares. Average: 8.5/10, standard deviation: 3.2.

Part (a). I had expected the formula involving summations, but some had evaluated the sums and wrote that down — I allowed it. A few decided on having a 3×3 matrix corresponding to a full quadratic fit including the constant, which isn't what I asked for.

Part (b) was often correct. Would have preferred four decimal places.

Q6. Iteration schemes and root finding. Average: 9.1/10, standard deviation: 1.8.

Generally extremely good.

Q7. ODE solutions with eigenvectors. Average: 9.7/10, standard deviation: 1.0.

At last, a class that adores eigenvalues and eigenvectors! The best question on the paper. Clearly you didn't need a video from me...

Q8. Laplace Transforms and ODEs. Average 8.0/10, standard deviation: 2.9.

Some fairly complicated work was needed with part (a) and this was generally very good. Some answers were incorrect and I suspect that the partial fractions was to blame. In part (b) many students sketched the velocities rather than the displacements. For part (c) often the reasoning behind the violation of the initial condition for y didn't mention y. Those who mentioned the impulse acting on the right hand mass were credited with the full mark. Some people thought it was the fault of friction!

Q9. Some classic second order ODEs. Average 8.8/10, standard deviation: 2.4.

Part (a) was marginally less well-done than part (b).

Q10. ODEs with a coordinate transformation. Average: 8.1/10, standard deviation: 3.0.

There were many minor glitches in the answers, some involving missing terms or an incorrect integrating factor. Given how many of these there were I am surprised that the average is as high as it is. That said, there were many with full marks, and those who did poorly did very poorly, hence the large standard deviation.

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