MTHS2007 Exam Feedback 2019-20

1. This was a very standard question on constant coefficient ordinary differential equations, and was generally well-answered. Confusion between x, y and t caused some unnecessary dropped marks. Worryingly many people differentiated 2x with respect to t and obtained 2, instead of 2dx/dt. It's important to be clear from the outset what the dependent and independent variables are.
2. This was a very standard question on Fourier series, and was generally well-answered. An ability to integrate by parts was all that was lacking in most wrong answers.
3. This was a very standard question on Laplace transforms, and was generally well-answered. Integration by parts proved troublesome for some in part (a). It is also worth noting that the Laplace transform of y(t) is not $1/s^2$.
4. This question mainly asked you to reproduce the very first example that I did in the lectures on solutions of partial differential equations. Most people could not do this. I don't know why not.
5. Each part of this question was very similar to examples and exercises in the notes and problem sheets.
   In part (a) most used the formula for conditional probability successfully, but quite a few tried to use the sum rule or conditioned on the wrong event (A rather than B). In (ii) a significant minority wrote $P(A|B') = P(A \cap B) / P(B')$ instead of $P(A \cap B') / P(B')$, and then another significant minority did not calculate $P(A \cap B')$ correctly.
   In (b) there were lots of correct answers, but also quite a few who calculated $P(X <= 1)$ instead of $P(X>1) = 1-P(X <= 1)$ and also quite a few who thought that the formula on the formula sheet was for $P(X <= k)$ instead of $P(X = k)$.
   In (c) (i) most used the right method but there were quite a lot of marks lost for little things like calculating $P(X<600)$ instead of $P(X>600)$ and standardising using the wrong mean and standard deviation, i.e. calculating P(frame>600) instead of P(door>600). Part (ii) caused problems since lots of answers did not recognise the need to consider a new random variable that is the difference of the two random variables that were given. Of those that did recognise that, there was a significant number who then made an error in calculating and/or using the standard deviation of the new random variable.
   In (d) the large majority used the formula correctly to find the CI, but significant minorities calculated the wrong critical value from the standard normal distribution and/or used the variance 2.1 in the formula instead of the standard deviation $\sqrt{(2.1)}$. Interpretation of the CI was where a lot of people lost marks, though this was done well by a significant minority. Very few students seemed to look at the units of the data (litres per hour) and recognise that a smaller value is better. A significant minority seemed to do the interpretation as though the value to compare to was a claim made by a manufacturer (suggesting not really reading the question - this was the case in a couple of examples we saw) which meant that the conclusion they made didn't make sense.

JB and DS