Assignment 3 feedback

Copying/plagiarism

I got rather fed up marking versions of Q4 which all looked to be identical to work handed in by other students, including all the same mistakes around making the substitution. To a lesser extent this happened with Q5 as well.

Look: we know students are going to discuss assignments and that's fine. Discussing this stuff is a good way to get it clear in your head. But when it looks very like students are handing in copies of the same work then that's not on. It may be one student did the work and others copied it or it may be there's a website somewhere with a solution to question on it. Either way, handing work you have not done as if it is your own work is called plagiarism and *it is an assessment offence*.

General Feedback

Most people did pretty well on this assignment. Many people lost marks unnecessarily by not showing all their work to get from one line to the next. A few of you should definitely revise methods of integration particularly involving partial fractions and logs.

Quite a lot of you weren't sure how to cope with the constants of integration. Setting the constant equal to 1 seemed to be a popular idea. I'm not sure where you're getting this idea from but mathematically it does not make sense. Others didn't bother with the constant at the point of integration but then added "$+C$" as a last step. This is not valid either. If your integral involves a log function then although we will get "$+C$" initially, when we then exponentiate both sides this turns into a new constant *multiplying* the others terms, not added to it.

For example:

$$\begin{aligned}\int \frac{1}{y}\mathrm{d}y &= \int 2x\mathrm{d}x\\ \ln y &= x^2 + C\\ y &= e^{x^2+C}\\ &= e^{x^2}e^{C}\\ &= Ae^{x^2}\end{aligned}$$

where $A = e^C$ is a new constant. If you ignore the constant C and throw in a new constant at the end you would end up with:

$$y = e^{x^2} + A$$

which is not the same.

There are loads of resources online to practise this stuff. Just google "A level maths textbook pdf" or something and you'll find them. For excellent video tutorials going through examples step-by-step check out http://www.examsolutions.net/.

Question 1

The three methods I was hoping you would use were separation of variables, homogeneous DE and exact DE. Lots of you used these methods though few people justified the use of the homogeneous method. Remember the substitution $y = xv$ assumes that the DE is homogeneous so you should always check this explicitly before doing the substitution. So you need to show $M(\lambda x, \lambda y) = \lambda^n M(x, y)$ and $N(\lambda x, \lambda y) = \lambda^n N(x, y)$ for some n. Otherwise you could do a lot of work to end up with an DE that does not separate.

A few times I saw people make this move:

$$y^3 = -x^3 + C$$
$$y = -x + \sqrt[3]{C}$$

which is *not* valid. It is *not* true that $\sqrt[3]{A+B} = \sqrt[3]{A} + \sqrt[3]{B}$ . . .

Question 2

The two methods I was expecting were separation of variables and homeogeneous DE. Most of you got them, again many forgetting to do the check for homogeneity explicitly.

A few times people who could not think of a second method used differentiation to check the solution they found in part (a). While this is a valid way of *checking* a solution it does not count as a second method of *finding* a solution and so gets no marks.

Question 3

Many of you were able to show that $\mu(x, y)$ was an integrating factor. A few people were thinking in terms of the integrating factor $e^{\int P(x)\mathrm{d}x}$ which we used in chapter 4. Actually this question uses a different kind of integrating factor as it is a function of both x and y.

In part (b) a lot of people showed that the integrating factor from part (a) did indeed make the equation exact but then went on to solve it by separating variables again. But as you had used the method of separating variables in 2(a) or 2(b) this did not count as a different method. The reason I got you to do 3(a) was to show you that you could used the method of an exact DE for this question eventhough it did not look like it at first glance.

Question 4

This was the worst answered question. If you did not do well in it then revise the chain rule. It's fiddly and there's some algebra and minus signs that can trip you up but if you practise these kinds of questions then they look nastier than they are.

A few people made it through the substitution and solved the resulting equation to get $y = Ae^{2t} + Be^{-2t} - 1$ but did not then make the final substitution to get y in terms of x. Remember

when solving a DE you always want the answer to be in the same variables that the question was posed in.

Question 5

Well done on the whole. Many people took the long way to go from the roots of the auxiliary equation to make the equation itself. See my solution for a quicker way to do it. There's an even faster way that some of you used using the fact that in the quadratic:

$$x^2 + bx + c$$

then $b = -$(sum of roots) and $c =$ (product of roots).

Some of you also took a very long was round to find the $S(x)$ on the right hand side of the DE. You had $p(x)$ given to you in the question so to make $S(x)$ you can just run $p(x)$ through the homogeneous bit that you found from the auxiliary equation since, by definition, $p(x)$ is the part that makes $S(x)$.