

ESAM 311-1 Methods in Applied Mathematics

Fall Quarter 2007

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Problem Set 2

Due Friday October 26, 2007

Do problems 3.4.1, 3.4.2, 3.4.3, 3.4.5, 3.4.8, 3.4.10, 3.4.15.

Notes:

1. You may run into difficult integrals like $\int e^x x/(x+1)^2 dx$. For this integral one has to use a trick together with integration by parts:

$$\begin{aligned}\int e^x \frac{x}{(x+1)^2} dx &= \int e^x \frac{x+1}{(x+1)^2} dx - \int e^x \frac{1}{(x+1)^2} dx \\ &= \int e^x \frac{1}{x+1} dx - \left(e^x \frac{-1}{x+1} + \int e^x \frac{1}{x+1} dx \right) \\ &= e^x \frac{1}{x+1}.\end{aligned}$$

i.e. while the integration by parts leads only to another difficult integral, it turns out that in this case the difficult integral cancels the other difficult integral.

2. If you can show using the Fredholm Alternative Theorem that there is no solution, there is no need any more to compute any particular solution etc.
3. For some problems you may want to employ theorem 4, which states that the solution to the initial-value problem is unique.