Name: Solutions Date: 04/12/2018

M20580 L.A. and D.E. Tutorial
Quiz 9

1. Find an integrating factor for the following differential equation (**Note**, you DON'T need to solve it!)

$$y' = t^3 - 2ty$$

$\Rightarrow y' + 2ty = t^3$

$\mu(t) = e^{\int 2t\,dt} = \boxed{e^{t^2}}$

2. **Solve** the differential equation $y' = y^2 e^t$ subject to the initial condition $y(1) = \frac{1}{e}$.

$\frac{dy}{dt} = y^2 e^t$ (separable eq'n)

$\Rightarrow \frac{dy}{y^2} = e^t\,dt \Rightarrow \int y^{-2}\,dy = \int e^t\,dt \Rightarrow -\frac{1}{y} = e^t + C$

$\Rightarrow y = \frac{-1}{e^t + C}$

$y(1) = \frac{1}{e} \Rightarrow \frac{1}{e} = \frac{-1}{e + C} \Rightarrow e + C = -e \Rightarrow C = -2e$

Thus, $\boxed{y = \frac{-1}{e^t - 2e}}$ or $\boxed{y = \frac{1}{2e - e^t}}$