Name Ak.

Diff. Equations and Lin. Alg.
Math 3280
Quiz 2, Fall 2018
B. Peckham

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1. (2 pts) Consider the following differential equations. For each equation, state whether it is separable, linear, both or neither? (Do not solve.)

   $y' = ye^x$ $y' = y + e^x$

   $y' = xe^y$ $y' = x + e^y$

2. (4 pts) Use the first order linear differential equations technique (using an integrating factor) to obtain the general solution to the following differential equation and the solution that satisfies the initial value problem. Show your work and clearly indicate your final answer.

   $\frac{dr}{dt} = 3r, r(1) = 2.$ $\dot{r} - 3r = 0$ Let $\mu(t) = e^{-3t}$

   $r(2) = 1$

   $e^{-3t}\dot{r} - 3re^{-3t} = 0 \cdot e^{-3t}$

   $\Rightarrow \frac{d}{dt}(e^{-3t}r) = 0$

   $\Rightarrow e^{-3t}r = 0 + C$ → $r(t) = Ce^{3t}$

   $r(2) = 1$

   $1 = Ce^{3\cdot 2}$

   $C = e^{-6}$

   $r(t) = e^{-6}e^{3t}$

   $r(1) = 2$

   $2 = Ce^{3\cdot 1}$

   $C = \frac{2}{e^3}$ → $r(t) = \frac{2}{e^3}e^{3t}$

3. (3 pts) Consider the differential equation $\frac{dP}{dt} = (t - P)^3$. Make the substitution $u = t - P$ to eliminate the variable P. Write the new differential equation. Show your work. Do not solve the differential equation. Extra Credit (+1 pt) Is this substitution useful in solving the differential equation? Why?

   $u = t - P \Rightarrow \dot{u} = 1 - \dot{P} \Rightarrow \dot{P} = 1 - \dot{u}$ → $1 - \dot{u} = u^3$ or $\dot{u} = 1 - u^3$

   EL. New de. is Sep.!

4. (1 pt) A differential equations model for the temperature $T(t)$ of a cup of coffee at time t is $\frac{dT}{dt} = k(T(t) - R)$, where R is the constant room temperature. Should k be a positive or a negative constant? Justify.

   If $T > R$, $T - R > 0$. $\dot{T}$ should be neg., so $k < 0$.