Differential Equations Midterm
Review Sheet

Topics Covered:

Checking whether a given function solves a Differential Equation.

Modeling using Differential Equation: given a word problem scenario, translate into a differential equation (defining all units, variables) and then solve. Sec 1.1, 1.2, 1.8

Separation of Variables (S. 1.2)

Qualitative Methods: Slope fields (S. 1.3), autonomous, non-autonomous, equilibrium solutions, phase line (S. 1.6)


Existence and Uniqueness (S. 1.5). Be able to determine if the conditions for Existence and for Uniqueness are satisfied. (Is it Tuesday?).

Bifurcations (S. 1.7).

Linear Equations (S. 1.8).
  Homogeneous; non-homogeneous.
  \[ y_{\text{general}} = y_{\text{homogeneous}} + y_{\text{particular}} \]
  Method of undetermined coefficients to solve for \( y_{\text{particular}} \).

Theorems (be able to demonstrate):
1. If \( y_1(t) \) and \( y_2(t) \) are solutions of a homogenous linear differential equation, then all linear combinations \( y(t) = c_1 y_1(t) + c_2 y_2(t) \) are also solutions.
2. If \( y_1(t) \) and \( y_2(t) \) are particular solutions of a non-homogenous linear differential equation, then \( y(t) = y_1(t) - y_2(t) \) is a solution of the associated homogenous linear differential equation/