MTH 267, Homework #1, Fall 2022   Name _____

Instructions: Work problems on a separate sheet of paper and attach work to this page. You should show all work to receive full credit for problems. Checking your work with computer algebra systems is fine, but that doesn't count as "work" since you won't be able to use CAS programs on exams or quizzes. Graphs and longer answers that won't fit here, indicate which page of the work the answer can be found on and be sure to clearly indicate it on the attached pages.

1. Verify that each function is a solution to given differential equation.
   a. $y'' - y = 0, y_1(t) = e^t, y_2(t) = \cosh(t)$ c. $ty' - y = t^2, y_1(t) = 3t + t^2$
   b. $y^{IV} + 4y''' + 3y = t, y_1(t) = \frac{t}{3}, y_2(t) = \frac{t}{3} + e^{-t}$

2. Find the values of r for which the differential equation has a solution of the given form.
   a. $y'' + y' - 6y = 0, y = e^{rt}$ b. $t^2 y'' + 4ty' + 2y = 0, y = t^r$

3. Use a direction field graphing program to graph the following direction fields.
   a. $y' = e^{-t} + y$ b. $y' = \frac{1}{6}y^3 - y - \frac{1}{3}t^2$ c. $y' = t + 2y$

4. Differentiate.
   a. $y = te^t$ c. $y = e^t \cos 2t$
   b. $y = e^{t^2} \int_0^t e^{-s^2} ds + e^{t^2}$ d. $y = (\cos t)\ln(\cos t) + t\sin t$

5. Integrate.
   a. $\int \frac{t}{1-t} dt$ c. $\int \frac{1}{4+t^2} dt$ d. $\int x^2 e^x dx$
   b. $\int y \sin y^2 \, dy$ e. $\int \cos^2 t \, dt$

6. Determine whether the equation $\frac{d^3 y}{dt^3} + t\frac{dy}{dt} + (\cos^2 t)y = t^3$ is linear or nonlinear. Explain why or why not? What is the order of the equation? Is it ordinary or partial?