Instructions:

> Solve the following problems, simplifying the solution as much as you can.
> Use loose-leaf paper, not pages torn out from a spiral notebook.
> Staple the pages together in the upper left-hand corner.
> Write your name, Math 527, section #, HW 1 in the upper-right corner of the 1st page.
> **Your work, name, and section number must be legible and organized!**

Solve the differential equation using separation of variables. For #4 solve the initial value problem.

1. $\dfrac{dy}{dt} = (1 + t)(1 + y)$

2. $\dfrac{dy}{dt} = 1 - t + y^2 - ty^2$

3. $\dfrac{dy}{dx} = e^{x+y+3}$

4. $\dfrac{dy}{dt} = \dfrac{2t}{y + yt^2}, \quad y(2) = 3$

Solve the 1st-order linear differential equation using an integrating factor. For #8 solve the initial value problem.

5. $\dfrac{dy}{dt} + y \cos t = 0$

6. $\dfrac{dy}{dx} + \dfrac{2xy}{1 + x^2} = \dfrac{1}{1 + x^2}$

7. $(1 + t^2)\dfrac{dy}{dt} + ty = (1 + t^2)^{5/2}$

8. $\dfrac{dy}{dx} - 2xy = x, \quad y(0) = 1$

Find all solutions of the differential equation, both a family of solutions parameterized by an arbitrary constant and a singular solution.

9. $\dfrac{dy}{dx} = x\sqrt{1 - y^2}$

These problems are taken from M. Braun "Differential Equations and Their Applications," Springer-Verlag *Applied Mathematical Sciences* series, volume 15, 1975.