1. Solve the differential equation

$$(1+t^2)y' + y = 1.$$

2. Suppose that you are solving the equation y' = -xy approximately, using Euler's method. If you start at the point (x_0, y_0) , and take a step size of h, write down formulas for your new location, (x_1, y_1) . Your formulas should be in terms of $x_0, y_0,$ and h:

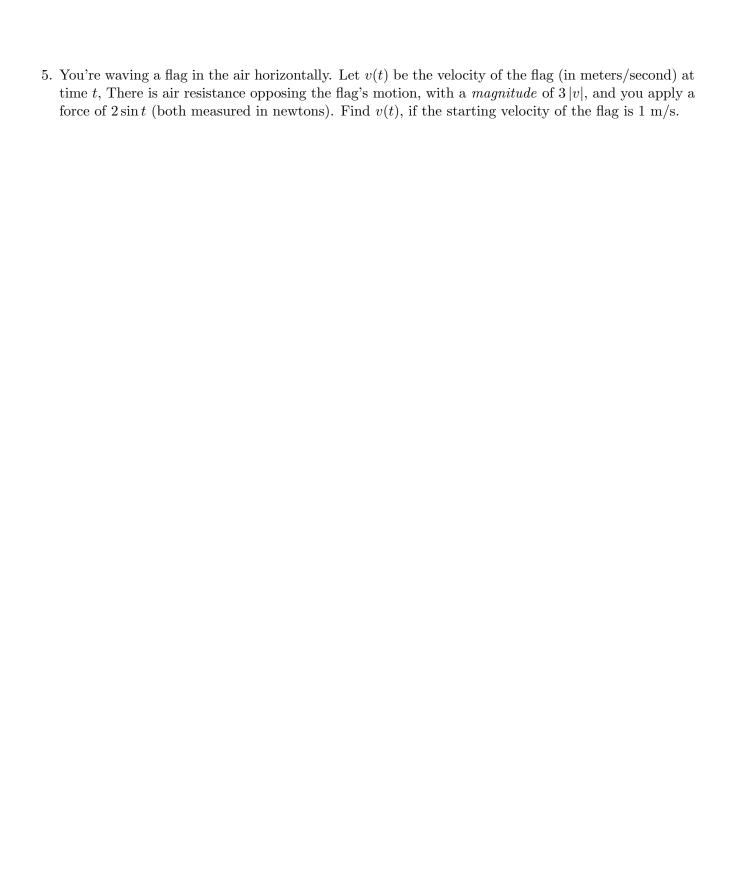
$$x_1 =$$

$$y_1 =$$

3. Solve the differential equation

$$-2ty' + (t+1)y = ty^3$$

4. Initially, a tank contains 6 gal of water containing 1 lb of salt. There is water flowing into the tank through two pipes: Water containing salt is entering the tank through the first pipe at rate of 2 gal/min. Several measurements indicate that the amount of salt contained in one gallon of the incoming water is $e^{-3t/2}$ lb at time t. One gallon of fresh water per minute is entering the tank through the second pipe. Finally, the well-stirred mixture is draining the tank at a rate of 3 gal/min. Determine the amount of salt at any time $t \ge 0$.



6. A bird population y(t) (measured in millions of birds) has the differential equation

$$y' = y\left(e^{-y} - \frac{1}{2}\right).$$

- (a) Find the equilibrium solutions and classify each of them as stable, unstable, or semistable.
- (b) Sketch the direction field.
- (c) If the starting population is y=1, find the limit of the population as $t\to\infty$.