1. Find the general solution of the given differential equation.

(a) 
$$y' + 2ty = 2te^{-t^2}$$
.

(b) 
$$y' = \frac{3x^2 - 1}{3 + 2y}$$
.

(c)  $y' = 2x \sec y$ .

(d)  $ty' + y = 3t \cos t$ , t > 0.

2. Find the solution to the initial value problem

(a) 
$$\frac{dy}{dx} = 4x^3y - y$$
,  $y(1) = -3$ .

(b) 
$$\frac{dy}{dx} + \frac{2y}{t} = \frac{\cos t}{t^2}$$
  $y(1) = \frac{1}{2}$ ,  $t > 0$ .

(c) 
$$2\sqrt{x}\frac{dy}{dx} = \cos^2 y$$
,  $y(4) = \frac{\pi}{4}$ .

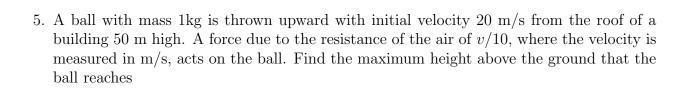
## 3. Consider the initial value problem

$$y' + 2y = 5 - t, \qquad y(0) = y_0$$

Find the value  $y_0$  for which the solution touches, but does not cross the t-axis.

4. Consider a cascade of 2 tanks, with  $V_1 = 100$  gal and  $V_2 = 200$  gal the volume of brine of the 2 tanks. Each tan also initially contains 550lb of salt. Pure water flows into the first tank at a rate of 5 gal/min. The mixture flows from the first tank to the second one and flows out of the second tank at the same rate (5 gal/min).

Find the amount of salt in the 2 tanks at any time t.



6. College graduate borrows \$10,000 to buy a car. The lender charges interest at an annual rate of 10%. Assuming that the interest is compounded continuously and that the borrows makes payment continuously at a constant annual rate k, determine the payment rate k that is required to pay off the loan in 5 years. Also determine how much interest is paid during the 5-year period.

7. Food, initially at a temperature of 40°F, was placed in an oven preheated to 350°F. After 10 minutes in the oven, the food had warmed to 120°F. After 20 minutes, the food was removed from the oven and allowed to cool at room temperature (72°F). If the ideal serving temperature is 110°F, when should the food be served?