HW2

(NOTE: see HW1 for problems assigned from section 2.1)

SECTION 2.2

(1) Solve $y' = (3x^2 - 1)/(3 + 2y)$

(2) Determine the interval over which the equation has defined solutions:

$$y' = 2x/(y + x^2 y) \qquad y(0) = -2$$

Find a solution as well.

(3) Some questions for

$$y' = 3x^2/(3y^2 - 4) \qquad y(1) = 0$$

Hint: look for points where the integral curve has a vertical tangent, to find the interval of definition.

(4) Solve $\dfrac{dy}{dx} = -\dfrac{4x + 3y}{2x + y}$

SECTION 2.3

(5) A tank originally contains 100 gal of fresh water. Then, water containing ½ lb of salt per gallon is poured into the tank at a rate of 2 gal/min and the mixture is allowed to leave at the same rate.
After 10 mins the process is stopped, and fresh water is poured into the tank at a rate of 2 gal/min, with the mixture again leaving at the same rate. Find the amount of salt in the tank at the end of an additional 10 mins.

(6) A ball with mass 0.15 Kg is thrown with initial velocity 20 m/s from the roof of a building 30m high. Neglect air resistance
(a) Find the maximum height above the ground that the ball reaches.
(b) Assuming the ball misses the building on the way down, find the time it hits the ground.

(7) A rocket sled having an initial speed of 150 mi/hr is slowed by a channel of water. Assume that, during the breaking process, the acceleration a is given by $a(v) = -\mu v^2$ where v is the velocity and μ is a

positive constant. Find the time τ required to slow down the sled to 15 mi/hr.

Use the Example 4 in section for guidance. Also note that

$$\frac{dv}{dt} = v\frac{dv}{dx} \quad \text{(chain rule)}$$

SECTION 2.4

(8) Without solving equation, determine an interval in which the solution is certain to exist:

$$(t-3)y' + (\ln t)y = 2t \qquad y(1) = 2$$

(9) When in the ty plane the hypotheses of Theorem 2.4.2 are satisfied, for

$$y' = \frac{t-y}{2t+5y}$$

(10) Solve $y' = 2ty^2$, $y(0) = y_0$

Determine how the interval in which the solution exists depends on y_0.