## Exam 2 Review

## DIFFERENTIAL EQUATIONS

$$\frac{dy}{dx} = \left(1 + y^2\right)e^x \qquad y(0) = 0$$

$$y(0) = 0$$

$$\frac{dy}{dx} = (y^2 - 1)\cos(x) \qquad y(0) = 1$$

$$y(0) = 1$$

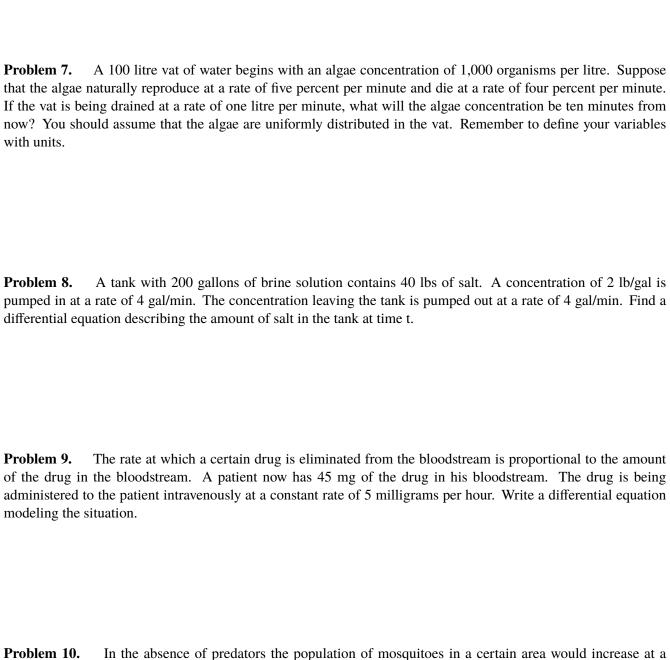
$$x\frac{dy}{dx} + 2y = -\frac{\sin(x)}{x} \qquad y\left(\frac{\pi}{2}\right) = 1$$

$$y\left(\frac{\pi}{2}\right) = 1$$

$$\frac{1}{2x}\frac{dy}{dx} = y + e^{x^2}.$$

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

## **Problem 6.** Find the exact solution to the initial value problem $\frac{dy}{dx} = -2xy$ where y(0) = 1. Then use Euler's method with step size $\Delta x = 0.1$ to estimate y(0.3).



**Problem 10.** In the absence of predators the population of mosquitoes in a certain area would increase at a rate proportional to its current population and its population would double every three weeks. There are 250,000 mosquitoes in the area initially when a flock of birds arrives that eats 80,000 mosquitoes per week. How many mosquitoes remain after two weeks?

## Taylor Polynomials/Series

**Problem 11.** For  $f(x) = x^4 + x + 1$ , find the degree three Taylor polynomial of f(x) around 1. That is, find  $T_3^1 f(x)$ .

Problem 12. Hadrubal has designed a rocket. While proving mathematically that it won't ex