Math 2250-1 Super Quiz (Week 4)

Name and uID: _____

Write your answer in the space provided. Show work for full credit. You do not need to numerically evaluate all expressions for full credit

1. (10 points) **Problem 1**
   An accelerometer in a car measures an acceleration over $t = 0$ to 1 seconds given by the function
   $$a(t) = -100\sin(\pi t)$$
   measured in meters per seconds squared. The car was initially traveling with velocity 100 meters per second. Write down and solve the appropriate differential equation to find the velocity $v(t)$ after one second.

2. (10 points) **Problem 2**
   Solve the differential equation
   $$\frac{dx}{dt} = x^2\sqrt{t}$$
   for $x(t)$, with initial value $x(4) = 2/3$.

3. (10 points) **Problem 3**
Suppose a 10-liter tank contains 10 liters of water and 0 liters of ethanol at time $t = 0$. A solution of ethanol and water is continuously mixed into the tank at a rate $r = 2$ liters per minute with concentration given by $0.5e^{-t}$. The mixed up solution is removed from the tank at the same rate. Let $x(t)$ be the volume in liters of ethanol in the tank at time t in minutes. Find $x(t)$ by solving the appropriate differential equation.