1. Consider a tank which has 400 gallons of a salt-water mixture. Initially, the tank has 15 lbs of salt in it. Water flows into the tank at a rate of 30 gallons per minute, and there is 1/2 lb of salt per gallon. There is a mixing device in the tank which keeps the salt evenly distributed throughout the salt-water mixture. The salt-water mixture flows out of the tank at a rate of 30 gallons per minute. Find the concentration (lbs per gallon) of salt in the tank in the long run.

2. Consider a tank which has 400 gallons of pure water, and has a capacity of 700 gallons. Salt water begins to flow into the tank at a rate of 5 gallons per minute and there are 10 grams of salt per gallon. There is a mixing device in the tank which keeps the salt evenly distributed throughout the tank. The mixture in the tank flows out at a rate of 3 gallons per minute. How much salt will be in the tank the instant it begins to overflow?

3. Pete stands at the top of a 40 meter building and throws a hammer upward with a speed of 5 m/s. Suppose there is a force due to air resistance acting on the hammer in the opposite direction of velocity with a magnitude of $\frac{|v|}{22}$ m/s. Set up a differential equation to model this scenario (use g = 9.8 m/s^2 as the magnitude of the acceleration due to gravity).

4. Suppose that the rate of change of a function f is proportional to a function g. Write a differential equation which expresses this situation.

5. Newton's Law of Cooling states that the temperature of an object changes at a rate proportional to the difference between its temperature and that of its surroundings. Suppose that the temperature of a cup of tea obeys Newton's Law of Cooling. Assume the tea has a temperature of 190° F when freshly poured, and 2 minutes later has cooled to 175° F in a room at 72° F. Find a function for the temperature T of the tea at time t.

6. Suppose that a rocket is launched straight up from the surface of the Earth with an initial velocity of $v_0 = \sqrt{2gR}$, where R is the radius of the Earth. Neglect air resistance. Find an expression for the velocity v in terms of the distance x from the surface of the Earth. Find the time required for the rocket to go 140,000,000 miles (the approximate distance from Earth to Mars). Assume that $R = 4000$ miles. Assume that the acceleration due to gravity $g = 32$ ft/s^2 (There are 5280 feet in a mile.)

7. If Jack weighs 200 lbs, what is his mass?