Homework 9: Work and Sequences (due Mar. 13)

1. A man with mass 80 kg is hanging 18 meters off the side of a building by a rope. How much work is required to lift the man safely to the top of the building? Assume that linear density of the rope is 0.1 kg per meter.

2. A water tank is in the shape of a cylinder with height 20 ft. and radius 6 ft. Suppose the tank is full of water. Find the work needed to pump all of the water to a point 10 ft. above the top of the tank.

3. A gas station stores its gasoline in a tank under the ground. The tank is a cylinder lying horizontally on its side. The radius of the tank is 4 ft. and the length is 12 ft. Its top is 10 ft. underneath the ground. Find the total amount of work needed to pump the gasoline out of the tank (the density of gasoline is 42 lbs/ ft^3).

4. A new car costs \$20,000 and loses 12% of its value each year. Repairs are \$400 for the first year and increase 18% each following year.

(a) Let d_n be amount of value (in dollars) the car loses after n years. For example, $d_1 = 20,000 - 0.12(20,000)$. Find a general formula for d_n.

(b) Let r_n be the amount (in dollars) that you have to pay in repair costs in the n^{th} year of owning your car. For example $r_1 = 400$. Find a general formula for r_n.

(c) If you sell your car after n years, how much money (in total) did it cost for you to own your car?