MATH 246 Homework 1.6
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Directions:

- Work should be done neatly and on separate paper.
- Enough work must be shown so that the steps you are taking is clear.

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1. In dealing with an infestation of cockroaches you find that the growth rate is 5% weekly. Suppose there were 200 cockroaches initially and you manage to kill eight each week.
   (a) Solve the corresponding differential equation to find the number of cockroaches at time t.
   (b) Show algebraically that you will not kill off the infestation.
   (c) How many cockroaches must you kill weekly in order to eliminate the infestation after ten weeks?
2. A 1000L tank initially contains 700L of freshwater. Sugar water with a concentration of 0.1kg/L is pumped in at 30L/min while the tank is being emptied of the mixture at 20L/min.
   (a) Solve the corresponding differential equation to find the amount of sugar in the tank at time t.
   (b) How long will it be until the tank overflows?
   (c) At that point how much sugar will be in the tank?
3. Suppose a skydiver has a drag coefficient is 0.0025m^{-1}.
   (a) What is her terminal velocity?
   (b) Solve the corresponding differential equation to find her velocity at time t.
   (c) If her initial height is 3000m find her height at any time t and calculate how long it will take her to reach the ground.
4. If the terminal velocity of a skydiver needs to be 50m/s what would the drag coefficient need to be?