Exponential Growth and Decay- HW Problems

1. A population of a town today is 100,000. The town's population three years from now is expected to be approximately 135,000. Assuming that the population growth is exponential:

a.   find the annual relative growth rate.

b.   At this growth rate how long does it take the town's population to double?

c.   Find the absolute growth rate (i.e., $P'(t)$) of the population when it has doubled.

2.   A certain bacteria culture grows at a rate proportional to its size. After 2 hours the number of bacteria was 600 and after 6 hours it was 38,400.

a.   Find the relative growth rate.

b.   what was the size of the population at $t = 0$?

c.   Find a formula for the size of the population at time t.

d.   Find the number of bacteria after 4 hours.

e.   What is the absolute rate of growth of the population at
      $t = 4$ hours.

f.   When will the population reach 75,000?

3. The population of the United States is given in the table below.

Year | Population in millions

Year	Population in millions
1950	161
1960	189
1970	213
1980	237
1990	259
2000	291

a. Assuming the population grows according to an exponential model, use the populations in 1950 and 1960 to project the population in 2000.

b. Us an exponential model and populations in 1960 and 1980 to project the population in 2000.

4. Cesium-137 decays according to an exponential model. The half-life of cesium-137 is 30 yrs. Suppose you start with a sample of 500mg.

a. Find the mass after t years.

b. How much will be remaining after 200 years?

c. When will there be just 1 mg left?

5. A radioactive element decays according to an exponential model. This element decays to 90% of its original amount in 20 years.

a. What is the half-life of the element?

b. How long will it take for the sample to decay to 10% of its original mass?

6. A turkey is heated in an oven to a temperature of $350°F$. 30 min. after it is taken out of the oven and placed on a counter where the room temperature is $70°F$, the temperature of the turkey is at $120°F$.

a. What is the temperature of the turkey 1 hour after it's been removed from the oven?

b. When is the turkey's temperature $200°F$?

7. $10,000 is invested in an account that pays an annual interest rate of 4% compounded continuously.

a. How much money will be in the account after 4 years?
b. How long will it take for the money in the account to double?

c. What is the equivalent semi-annually compounded interest rate?