6.8 – Exponential Growth and Decay

1. Set up and solve the differential equation defined by the statement: "The rate of change of a quantity is directly proportional to the quantity itself.

2. (a) Find an exponential growth model for the world population given that the world population was approx. 2.56 billion in 1950 and 3.04 billion in 1960. (b) Use the model to estimate the world population for this year. (c) According to the model, when will the world population be 10 billion?

- 3. Complete #4 on page 243.
 - **4.** A bacteria culture grows with constant relative growth rate. The bacteria count was 400 after 2 hours and 25,600 after 6 hours.
 - (a) What is the relative growth rate? Express your answer as a percentage.
 - (b) What was the intitial size of the culture?
 - (c) Find an expression for the number of bacteria after t hours.
 - (d) Find the number of cells after 4.5 hours.
 - (e) Find the rate of growth after 4.5 hours.
 - (f) When will the population reach 50,000?

4. The half-life of radium-226 is 1590 years. Suppose we have a sample of radium-226 of mass 100 mg. (a) Find a model for the mass of the sample after *t* years. (b) Find the mass of the sample after 1000 years. (c) When will the mass be reduced to 30 mg?

5. How long will it take an investment of \$1000 to double if the interest rate is 6% compounded continuously?

6. <u>Newton's Law of Cooling</u>: Suppose an object is cooling in an environment with constant temperature T_e . Set up and solve the differential equation defined by the statement: "The rate of change of the temperature of the object is directly proportional to the difference of the temperature of the object and the constant environmental temperature."

7. A can of Coke at room temperature (72 °F) is placed in a refrigerator set to 40 °F. After 30 minutes, the can of Coke has cooled to 60 °F. How long will it take the can of Coke to cool to 50 °F? What is the limiting value of the temperature of the can of Coke?