§5.5 Applications and Modeling with Exponential and Logarithmic Functions

Exponential Growth or Decay Function :

Let **a** be the amount or number present at time **t = 0**. Then, under certain conditions, the amount present at any time **t** is given by $\mathbf{y = ae^{bt}}$ where **b** is a constant. -the number **b** is the rate of growth or decay. -if **b > 0**, the function describes growth; if **b < 0**, the function describes decay.

- the **<u>doubling time</u>** of a quantity that grows exponentially is the amount of time that it takes for any initial amount to grow to twice that amount **y = 2a**

- the **<u>half-life</u>** of a quantity that decays exponentially is the amount of time that it takes for any initial amount to decay to half that amount **y = (1/2)a**

Example 1: A sample of 300 grams of radioactive plutonium 241 decays according to the function $A(t) = 300\, e^{-.053t}$, where t is time in years.

a.) Find the amount of the sample remaining after 5 years.

b.) Find the half-life of plutonium 241.

Example 2: A model of the world population (in millions) is given by $P(t) = 4451e^{0.017303t}$ where $t = 0$ represents 1980. According to this model, when will the world population reach 6 billion?

Continuous Compounding:

If **P** dollars is deposited at a rate of interest **r** compounded continuously for **t** years, the final amount on deposit is $\mathbf{A = Pe^{rt}}$ dollars.

Example 3: Suppose $5000 is deposited in an account paying 3% interest compounded continuously for 5 years. Find the total amount on deposit at the end of five years.

Example 4: How long will it take for the money in an account that is compounded continuously at 3% to double ?