4.8 Applications of Logarithmic and Exponential Functions

Exponential Growth and Decay

- Bacteria Growth
- Animal Populations
- Compound Interest
- Heat Transfer
- Half-Life

Ex 1: At 12:00, a single bacteria colonizes a can. The growth of the population can be modeled with the function

$$P(t) = 2^t$$

where t is time in minutes since 12:00.

a) How many bacteria are in the can at 12:05?

$$P(5) = 2^5 = 32$$

At 12:10?

$$P(10) = 2^{10} = 1024$$

b) The can is completely full at 1:00. At what time was the can 1/2 full of bacteria?

At 1:00, it's been 60 minutes

so, $2^{60} = 1.153 \times 10^{18}$

$\frac{1}{2}$ of $1.153 \times 10^{18} = 5.77 \times 10^{17}$

then $2^t = 5.77 \times 10^{17}$

$\log_2 2^t = \log_2 5.77 \times 10^{17}$

$t \approx 59$ minutes

Ex] Compound Interest $A(t) = P(1 + \frac{r}{n})^{nt}$

P = Principle

r = rate, in decimals

n = number of times per year interest
       is compounded

t = # of years

Continuously Compounded Interest

$$P = e^{rt}$$

Compare the investment of $P At

a) $8\frac{1}{2}\%$ per year compounded Quarterly
     r=

to   8% per year compounded
             continuously.