**Examples on Exponential Models**

Example 1:

(LP Pg 27 Q4)

A bacteria culture initially contains 100 cells and grows at a rate proportional to its size. After an hour the population has increased to 420.

(a) Find the number of bacteria after t hours.

(b) Find the number of bacteria after 3 hours.

(c) When will the population reach 10,000?

(d) Graph the model.

Soln.:

MATLAB Code:

%Equation

syms k t

y(t) = 100 \* exp(k \* t)

eqn = y(1) == 420

k = solve (eqn, k)

y (t) = simplify (subs (y(t)))

%Estimation

y\_3 = round (double (y(3)))

eqn = y(t) == 10000

t\_10000 = double (solve (eqn, t))

%Graph

fplot (y(t), [0 5], 'LineWidth', 1)

grid on

xlabel ('Time (in hours)')

ylabel ('Population size of bacteria')

hold off

Example 2:

(LP Pg 27 Q5)

Strontium-90 has a half life of 28 days.

(a) A sample has a mass of 50 mg initially. Find a formula for the mass remaining after t days.

(b) Find the mass remaining after 40 days.

(c) How long does it take for the sample to decay to a mass of 2 mg?

(d) Sketch the graph of the mass function.

Soln.:

MATLAB Code:

%Equation

syms k t

y(t) = 50 \* exp(k \* t)

eqn = y(28) == 25

k = solve (eqn, k)

y (t) = simplify (subs (y(t)))

%Estimation

y\_40 = double (y(40))

eqn = y(t) == 2

t\_2 = double (solve (eqn, t))

%Graph

fplot (y(t), [0 200], 'LineWidth', 1)

grid on

xlabel ('Time (in days)')

ylabel ('Mass of Strontium-90 (in mg)')

hold off