

Mathematical Modeling – MAT 506/606  
Fall 2013  
Homework 4

**Due date: October 2, 2013**

1. (12 points) Fit different polynomial models to the data in the table below and select the best one. Explain how you determined which one is “best.”

x	1.4	2.4	7.1	13.8	34.2	109.3	134
y	2.7	2.27	3.31	3.39	3.81	4.88	4.62

2. (8 points) [Graduate] The amount of a radioactive substance remaining after time  $t$ , is described by the exponential model  $y(t) = Ce^{-kt}$  where  $C$  is the initial amount (the amount at time  $t = 0$ ) and  $k$  is a constant. Suppose two radioactive substances  $A$  and  $B$  have constants  $k_A = 0.03$  and  $k_B = 0.05$ . A mixture of these two substances contains  $C_A$  grams of  $A$  and  $C_B$  grams of  $B$  at time  $t = 0$ , both of which are unknown. The total amount of the mixture at time  $t$  is modeled by

$$y(t) = C_A e^{-0.03t} + C_B e^{-0.05t} \tag{1}$$

A researcher measures the total amount of the mixture at several times and records the data in the table below. Estimate the values of  $C_A$  and  $C_B$  by fitting a least-squares model of the form (1) to the data.

<b>Time</b>	5	6	7	8
<b>Amount</b>	8.8	8.6	8.2	7.9