

## Math 486/522 - Homework 6

Fall 2024

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1. The following data is modeled by a power law.

$$y = at^c \quad (1)$$

$t$	$y$
1	2
1	4
2	5
5	10

- (a) Derive a linear model to replace (1). [Problem 1a answer here.](#)
- (b) Write a linear system  $Ax = b$  with  $x$  related to  $a$  and  $c$  using the data points. [Problem 1b answer here.](#)
- (c) State the normal equations then solve, you can use a computer for the calculation. [Problem 1c answer here.](#)
- (d) Plot the data points and the continuous function (1) using the computed values of  $a$  and  $c$  on the same graph. [Problem 1d answer here.](#)
2. The drug concentration in the plasma is modeled by the equation

$$y = ate^{ct}, \quad t \geq 0. \quad (2)$$

The following data was collected for the drug norfluoxetine in a subject:

hour	conc. (mg/ml)
1	8.0
2	12.3
3	15.5
4	16.8
5	17.1
6	15.8
7	15.2
8	14.0

- (a) Derive a linear model to replace (2). [Problem 2a answer here.](#)
- (b) Write a linear system  $Ax = b$  with  $x$  related to  $a$  and  $c$  using the data points. [Problem 2b answer here.](#)
- (c) State the normal equations then solve, you can use a computer for the calculation. [Problem 2c answer here.](#)

(d) Plot the data points and the continuous function (2) using the computed values of  $a$  and  $c$  on the same graph. [Problem 2d answer here.](#)

3. The table below gives car sales data starting at 1950 (year 0) in 5 year increments. The data is modeled by the exponential function

$$y = c_1 e^{c_2 t} \quad (3)$$

year	cars ( $\times 10^6$ )
0	53.05
5	74.04
10	98.31
15	139.78
20	193.48
25	260.20
30	320.39

- (a) Derive a linear model to replace (3). [Problem 3a answer here.](#)
- (b) Write a linear system  $Ax = b$  with  $x$  related to  $c_1$  and  $c_2$  using the data points. [Problem 3b answer here.](#)
- (c) State the normal equations then solve, you can use a computer for the calculation. [Problem 3c answer here.](#)
- (d) Plot the data points and the continuous function (3) using the computed values of  $c_1$  and  $c_2$  on the same graph. [Problem 3d answer here.](#)
- (e) Compute the RMSE in the linear model in (a). [Problem 3e answer here.](#)
- (f) Compute the RMSE using the exponential model in (3). [Problem 3f answer here.](#)
- (g) Explain any differences in (e) and (f).