Group: _____ _____ _____ Name: _____

ma138 Worksheet 18, November 2nd, 2017

1. Solve the linear system using any method:

$$\begin{bmatrix} 1 & 1 \\ 5 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 28 \end{bmatrix}$$

Then, find the least-squares solution to the linear system. What do you notice about these two results? Does this make sense? (**Hint**: All of the 2×2 matrices that show up in this problem will have determinant equal to 1.)

2. You are taking daily measurements of the population of a termite colony. On Monday the population was 99. On Tuesday, the population was 311. On Wednesday you forgot to take a measurement. On Thursday, the population was 2708. Assume the population is growing exponentially, and use the best-fit exponential curve to approximate the population on Wednesday, in the following steps:

a. Assuming $P(t) = ce^{dt}$, write the linear relationship between $\ln(P(t))$ and t by taking $\ln(\ \ )$ of both sides.

b. Write the three points $(t_i, \ln(P_i))$ for which you need to find the line of best fit.

c. Set up the linear system whose least-squares solution will give the line of best fit from part *b*.

d. Find the least-squares solution to the linear system, and interpret your result to find the constants c and d from part *a*.

e. Plug in the appropriate value of t to your equation to estimate the termite population on Wednesday.

3. If you have time the five points $(-2, 2), (-1, 1), (0, 0), (1, 1)$ and $(2, 2)$ do not lie on a parabola. Find the constants a, b and c that determine the best-fit parabola $y = ax^2 + bx + c$ for these five points