MA 138 Worksheet #21

Least Squares Approximations & Section 10.1

3/28/23

1. Fit a linear function of the form $f(t) = c_0 + c_1 t$ to the data points $(-9, -57)$, $(0, 3)$, $(9, 51)$, using least squares.

2. Ibuprofen is an over-the-counter anti-inflammatory drug often taken to treat headaches and other pain-related symptoms. Suppose that we expect a linear relationship of the form $y = at+b$, where y denotes the amount of the drug in an individual's system t hours after taking the recommended dosage. Through experimentation, we obtain the following data of drug concentration versus time elapsed.

time (hr)	concentration (ppm)
1	8
2	6
3	3
4	1

(a) Find a matrix equation that corresponds to the initial linear system that we wish to solve.

(b) Find the matrix equation whose solution is the least-squares solution to the system in part (a)

(c) Find the least-squares model of drug absorption that corresponds to this scenario.

3. (Similar to problem #8 in the WeBWorK assignment for HW10.1)

If $a_0 = 3$, $a_1 = 2$, and $a_{k+1} = -2a_{k-1} + 3a_k$ for all $k \geq 1$, use methods of linear algebra to determine the formula for a_k.

4. Evaluate the function $h(x, y, z) = xy^{-4}z$ at $(2, 2, 3)$ and $(4, 2, 2)$.

5. Find the largest possible domain and the corresponding range of each function.

Determine the equation of the level curves $f(x, y) = c$, together with the possible values of c.

(a) $f(x, y) = \ln(y - x^2)$;

(b) $f(x, y) = \dfrac{x - y}{x + y}$.