

# CS340 - Assignment 3

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## 1. Vectors, Matrices, and Quadratic Functions

### 1.1. Basic Operations

1.

$$x^T x = 2 * 2 + 3 * 3 = 13$$

2.

$$\|x\|^2 = (x^T x) = 169$$

3.

$$x^T (x + \alpha y) = \begin{bmatrix} 2 & 3 \end{bmatrix} \begin{bmatrix} 2 + 5 * 1 \\ 3 + 5 * 4 \end{bmatrix} = 2 * (2 + 5 * 1) + 3(3 + 5 * 4) = 83$$

4.

$$Ax = \begin{bmatrix} 2 * 1 + 3 * 2 \\ 2 * 2 + 3 * 3 \\ 3 * 3 + 3 * 2 \end{bmatrix} = \begin{bmatrix} 8 \\ 13 \\ 15 \end{bmatrix}$$

5.

$$z^T Ax = \begin{bmatrix} 2 & 0 & 1 \end{bmatrix} \begin{bmatrix} 8 \\ 13 \\ 15 \end{bmatrix} = 2 * 8 + 0 * 13 + 1 * 15 = 31$$

6.

$$A^T A \neq I$$

## 2. Linear Regression and Nonlinear Bases

## 3. Non-Parametric Bases and Cross-Validation

## 4. Robust Regression and Gradient Descent