

# ECE 3340 Numerical Methods

## Homework 3: Complexity Analysis

Name:

ID:

Solve the following problems from **Chapter 3, Discrete Math and Complexity**. Use any available space to work out the problem and **place your final solution in the box provided**.

**Problem 1: Provide the computational complexity of each operation using big-O notation.**

$\mathbf{A}\mathbf{v}$  where  $\mathbf{A} \in \mathbb{R}^{N \times N}$

Multiply  $N$  vectors  $\mathbf{v}_i \in \mathbb{R}^3$  by a transformation matrix  $T \in \mathbb{R}^{3 \times 3}$

$\mathbf{Y} = \mathbf{ABx}$  where  $\mathbf{A} \in \mathbb{R}^{N \times M}$ ,  $\mathbf{B} \in \mathbb{R}^{M \times N}$  and  $\mathbf{x} \in \mathbb{R}^N$

$\mathbf{x} \cdot \mathbf{y}$  where  $\mathbf{x}, \mathbf{y} \in \mathbb{R}^N$  (this is known as the *dot product*:  $\mathbf{x}^T \mathbf{y}$ )

$\mathbf{x} \otimes \mathbf{y}$  where  $\mathbf{x}, \mathbf{y} \in \mathbb{R}^N$  (this is known as the *tensor product*:  $\mathbf{x}\mathbf{y}^T$ )

**Problem 2: Use two iterations of Horner's algorithm to calculate  $p(x)$  and  $p'(x)$**

$$p(x) = 3x^4 - x^2 + 2x + 13 \quad \text{for } x = 5$$

calculate  $p(5)$  using synthetic division:

$$p(5) =$$

calculate  $p'(5)$  using synthetic division:

$$p'(5) =$$