ECE 3340 Numerical Methods

Homework 1: Prerequisite Mathematics

Name: **ID:**

Solve the following problems from **Chapter 1, Prerequisites: Mathematics**. Use any available space to work out the problem and **place your final solution in the box provided**.

Problem 1: Calculate $y = z^2 z^*$ where $z = (2 + 3i)$

Problem 2: Describe the Hilbert space of $\mathbf{y} = \mathbf{ABx}$ if $\mathbf{A} \in \mathbb{R}^{5\times4}$ and $\mathbf{x} \in \mathbb{C}^7$.

What is the Hilbert space of $\mathbf{B}$?

Problem 3: Calculate $\mathbf{x} \cdot \mathbf{y}$

The inner product $\mathbf{x} \cdot \mathbf{y}$ for complex vectors is defined as $\mathbf{x}^T \bar{\mathbf{y}}$ (where $\bar{\mathbf{y}}$ is the complex conjugate of $\mathbf{y}$). Calculate $\mathbf{x} \cdot \mathbf{y}$ for the complex vectors:

$$\mathbf{x} = \begin{bmatrix} 2i \\ -7 + 2i \\ 3 - i \end{bmatrix} \qquad \mathbf{y} = \begin{bmatrix} -1 + 2i \\ 1 - 3i \\ i \end{bmatrix}$$

Problem 4: Solve the following linear system using Gaussian Elimination

$x - 2y + 3z = 7$

$2x + y + z = 4$

$-3x + 2y - 2z = -10$

x= y= z=

Problem 5: Calculate a 4th order Maclaurin series for $f(x) = e^x \cos x^2$

$f(x) \approx$