CHEM 3PC3
Quiz #5
November 4, 2025

Name: _____

Student Number: _____

SUBMISSION INSTRUCTIONS — READ CAREFULLY

To receive full credit, you must follow these steps:

1. Answer all the questions.

2. Write your solutions on new, separate pages. Do not write your solutions in the margins of this paper.

3. At the top of each solution page, clearly write the corresponding question number (e.g., **"Question 5"**). If you use more than one page for a question, write the question number on each page (e.g., **"Question 5 (Page 1 of 2)"**).

4. **If you cannot solve a question, still attach a page with the question number and write "Blank" or "No Answer"** to indicate you attempted it.

5. **If you are unsure of a complete answer, still attempt the question:** attach a page with the question number and write down any relevant thoughts, formulas, or initial steps. Partial credit may be awarded for demonstrated effort and correct reasoning, whereas a blank answer will receive no credit.

6. Show all your work clearly and legibly. Unorganized or illegible work may not receive credit.

1   Problems

The following matrices are used in questions 1 and 2.

$$A = \begin{bmatrix} 1+i & 2i & 3 \\ 1-i & 2 & -3i \\ 2+3i & 1 & -1 \\ 4+9i & -4i & 3+2i \end{bmatrix} \quad B = \begin{bmatrix} 2-2i & 1+2i & 1-2i \\ 2+2i & 4i & 3 \end{bmatrix}$$

Let $B^\dagger$ denote the Hermitian transpose (also called the conjugate transpose) of the matrix B.

Consider the matrix $C = A \cdot B^\dagger$.

1. When we say C is an m by n matrix, what are the values of m and n?

2. What is the value of the element c_{21} of the matrix C?

3. Compute $A^{-1}u$, $A^{-1}v$, $A^{-T}u$ and $A^T v$, where

$$A = \begin{pmatrix} 2 & -3 \\ -2 & 4 \end{pmatrix}, \quad u = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

and

$$v = \begin{pmatrix} 1 \\ -1 \end{pmatrix}.$$

*HINT: Set up the augmented equations, and do Gauss-Jordan elimination.

4. Two matrices A and B are multiplied together. The result is a matrix of zeros, e.g., $AB = 0$. Is one of the two matrices, A or B, also entirely made of zeros? Show an example to justify your answer.