

## Math 22 Spring 2016, Homework 3, due Tuesday, April 19

*Instructions:* Write your answers neatly and clearly on straight-edged paper, use complete sentences, and label any diagrams. List problems in numerical order and staple all pages together. Start each problem on a new page. Please show your work; no credit is given for solutions without work or justification. If you are not sure what you are allowed to assume for a problem, ask!

1. (7 points) Let  $A$  and  $B$  be the  $3 \times 3$  matrices given by

$$A = \begin{bmatrix} 0 & 3 & 1 \\ 2 & 0 & -1 \\ -2 & 4 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & -5 & 2 \\ 0 & 3 & 2 \\ -1 & 2 & 1 \end{bmatrix}.$$

- (a) Calculate  $3 \cdot A$  and  $A + B$ .
- (b) Let  $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be the linear transformation whose standard matrix is  $A$ . Determine whether  $T$  is one-to-one and whether  $T$  is onto. Justify your answer.
- (c) Let  $S : \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be the linear transformation whose standard matrix is  $B$ . Find the standard matrices for the mappings  $S \circ T$  and  $T \circ S$ . Make sure to state which is which.
2. (5 points) Let  $C$  be the  $3 \times 3$  matrix given by

$$C = \begin{bmatrix} 4 & 6 & 1 \\ -1 & 2 & 2 \\ 5 & 7 & 1 \end{bmatrix}.$$

Determine the inverse matrix  $C^{-1}$ . Show all intermediate steps in your calculations.

3. (8 points) Determine which of the following matrices are invertible and which ones are not invertible. Justify your answer.

$$(a) \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \quad (b) \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ -1 & -2 & 0 \end{bmatrix} \quad (c) \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 1 \\ -1 & 1 & 0 \end{bmatrix} \quad (d) \begin{bmatrix} 1 & -1 & 1 & 0 \\ 2 & 1 & 5 & -2 \\ 1 & 0 & 2 & -1 \\ 1 & -1 & 1 & -2 \end{bmatrix}$$