

Date: Fall 2021

Name: _____

Instructor: Patricia Wrean

Math 251
Test 2

Total = $\overline{20}$

Show your work. All of the work on this test must be your own.

GOOD LUCK!

1. (4 points) Consider the matrices $A = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 5 \end{bmatrix}$, $C = \begin{bmatrix} 2 & 1 \\ 4 & -3 \end{bmatrix}$.

Evaluate the following, if they exist. If they do not exist, say so.

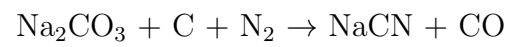
(a) AB

(b) BA

(c) B^{-1}

(d) C^2

2. (2 points) Set up BUT DO NOT SOLVE a system of equations that will allow you to balance the following chemical equation.



3. (5 points) Solve the following system using the LU method.

$$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ -3 & -2 & 1 \end{bmatrix} \begin{bmatrix} 2 & -1 & 4 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 9 \\ 7 \end{bmatrix}$$

4. (4 points) Consider the following 4×4 matrix A .

$$A = \begin{bmatrix} 1 & 2 & 1 & 1 \\ 1 & 2 & 2 & 1 \\ 3 & 6 & 4 & 3 \\ 2 & 4 & 2 & 3 \end{bmatrix} \xrightarrow{\text{RREF}} \begin{bmatrix} 1 & 2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

where

$$A^T = \begin{bmatrix} 1 & 1 & 3 & 2 \\ 2 & 2 & 6 & 4 \\ 1 & 2 & 4 & 2 \\ 1 & 1 & 3 & 3 \end{bmatrix} \xrightarrow{\text{RREF}} \begin{bmatrix} 1 & 0 & 2 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

- (a) Give the values of $\text{Rank}(A)$ and $\text{Nullity}(A)$.
- (b) Find a basis for $\text{Row}(A)$ in terms of the rows of A .
- (c) Find a basis for $\text{Col}(A)$ in terms of the columns of A .

5. (5 points) Consider the transformation T from R^2 to R^2 . T first reflects a vector about the y -axis, then rotates it by 30° clockwise, then reflects it in the line $y = x$.

Find the standard matrix A associated with this transformation and simplify your answer.

Hint: $R(\theta) = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$