Practice 2 for Midterm 1

Math 22A, Fall 2019

Name: ______________________________________

Student ID: ________________________________

You do not need to simplify numerical expressions for your final answers (e.g. you can write $3 - \frac{3}{4}$ instead of simplifying to $\frac{9}{4}$.)

Problem 1: Calculate the vector given by the following linear combination

$$c\begin{bmatrix}1\\3\end{bmatrix}+d\begin{bmatrix}-2\\-6\end{bmatrix}$$

Answer: ____________________

All linear combinations of

$$\begin{bmatrix}1\\3\end{bmatrix} \text{ and } \begin{bmatrix}-2\\-6\end{bmatrix} \text{ fill:}$$

A. A Line
B. A Point
C. Two-dimensional space

Answer: _________

All linear combinations of

$$\begin{bmatrix}1\\1\end{bmatrix} \text{ and } \begin{bmatrix}3\\0\end{bmatrix} \text{ fill:}$$

A. A Line
B. A Point
C. Two-dimensional space

Answer: _________

Problem 2: Calculate the dot product of the following two vectors:

$$\begin{bmatrix} 2 \\ 2 \\ -1 \end{bmatrix} \text{ and } \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}$$

Answer: ________

Fill in the blank:
If u and v are vectors and their dot product $u \cdot v = 0$, then u and v are ________.

Answer: ________________________

Is the angle between these two vectors

$$\begin{bmatrix} 2 \\ 2 \\ -1 \end{bmatrix} \text{ and } \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}$$

A. Less than 90°
B. Equal to 90°
C. Greater than 90° and less than 180°
D. Equal to 180°.

Answer: ________

Calculate the length of the vector

$$\begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$$

Length: __________

Which matrix multiplications are possible? (choose all that apply)

A. $\begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} -1 \\ 3 \\ -2 \end{bmatrix}$ **B.** $\begin{bmatrix} 1 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix}$ **C.** $\begin{bmatrix} 1 & 2 \\ 0 & 1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} 3 \\ 1 \end{bmatrix}$

Answer: ______________

Problem 3: Write out the following system of equations in matrix form $Ax = b$:

$$\begin{aligned} 2x_1 - x_2 \quad\quad\; &= 1 \\ + x_2 + 3x_3 &= 2 \\ 4x_1 - x_2 + 3x_3 &= 0 \end{aligned}$$

$$\begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$$

Which matrix E will do: replace the 3^{rd} row by the (3^{rd} row) – 2(1^{st} row) when multiplying EA?

$$E = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix}$$

What is the result of multiplying both sides of the equation above by E ($EAx = Eb$)? (Do what E does to both sides.)

$$\begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$$

Perform another row operation on both sides to change the resulting matrix to have all 0's below the diagonal. What is the result?

$$\begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$$

Which matrix F did you use to do that row operation?

$$F = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix}$$

Does the system of equations have

A. One solution
B. Infinitely many solutions
C. No solutions

Answer: __________

Problem 4: State whether or not the following matrices have an inverse or not:

$$\begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

A. Has an inverse
B. No inverse

Answer: __________

$$\begin{bmatrix} 2 & 1 \\ 0 & 0 \end{bmatrix}$$

A. Has an inverse
B. No inverse

Answer: __________

Calculate A^{-1} if A is the matrix

$$A = \begin{bmatrix} -1 & 0 & 1 \\ 0 & -1 & 0 \\ 2 & 0 & 1 \end{bmatrix}$$

Answer: ________________________________

Problem 5: Solve for the vector x:
Solve $Ax = b$ if

$$A = \begin{bmatrix} -17 & -7 & 4 \\ 5 & 2 & -1 \\ -3 & -1 & 1 \end{bmatrix}, \; b = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \quad \text{and } A^{-1} = \begin{bmatrix} 1 & 3 & -1 \\ -2 & -5 & 3 \\ 1 & 4 & 1 \end{bmatrix}$$

Answer: ______________________________

Find the line of solutions solving $Ax = b$ if

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 2 & 2 & 2 \end{bmatrix}, \quad \text{and } b = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$$

Answer: $\begin{bmatrix} 0 \\ \_\_ \\ \_\_ \end{bmatrix} + t \begin{bmatrix} \_\_ \\ \_\_ \\ 1 \end{bmatrix}$