Math 110 (A01, A02, A03)
Test 2
Version: A
October 25, 2019
Time: 45 minutes

Student ID: V00 ____________ Family (Last) Name: ____________

Given (First) Name: ____________

Tutorial sections (check one):

☐ T01 (Jaimes Joschko, 2:30, CLE A127)
☐ T02 (MacKenzie Carr, 2:30, CLE A308)
☐ T03 (Jacob Nagrocki, 2:30, HHB 110)
☐ T04 (Jacob Nagrocki, 3:30, HHB 110)
☐ T05 (Jaimes Joschko, 3:30, CLE C112)
☐ T06 (MacKenzie Carr, 3:30, CLE A203)
☐ T07 (Jaimes Joschko, 4:30, CLE C112)
☐ T08 (Jacob Nagrocki, 4:30, HHB 110)
☐ T12 (MacKenzie Carr, 4:30, CLE A203)

Question(s)	Value	Score
Question 1	1	
Question 2	1	
Question 3	1	
Question 4	1	
Question 5	4	
Question 6	4	
Question 7	4	
Question 8	4	
Total	**20**	

Instructions:

1. Identifying information:
   (a) Enter your Student ID and name at the top of this page now.
   (b) Select your tutorial section above now.
2. Only the following materials are permitted:
   (a) Pens, pencils, erasers, and a ruler are permitted at your desk. If you have a pencil case it must be stored with your belongings in the front of the room.
   (b) You may use a Sharp calculator with a model number beginning with EL510-R. No other calculators are acceptable on this examination.
3. No notes, outside paper, or aid other than the ones listed above is permitted. You are responsible for ensuring that any unauthorized material is stored with your belongings at the front of the room.
4. Show all calculations on this paper for all problems. We may disallow any answer given without appropriate justification.
5. If you require extra space, use the backs of test pages or the blank page at the end of the test. Be sure to clearly indicate where you have done so. No outside paper is permitted.
6. If you need to leave the room during the test, raise your hand until an invigilator comes to you.
7. This test has 8 pages, including this cover and the blank page at the end.

For questions 1–4, enter your final answer in the box provided. You must show your work to be given credit, even if your answer is correct.
Leave all answers in exact form - do not give decimal approximations. If it is impossible to answer a question using the given information, write "NA" in the box.

(1 point) 1. Let $A = \begin{bmatrix} 1 & 3 & -2 \\ -1 & 7 & -3 \end{bmatrix}$ and let $B = \begin{bmatrix} 2 & -1 & -1 \\ 3 & 3 & 1 \end{bmatrix}$. Find the $(2, 1)$ entry of the matrix $A + 2B$.

Answer:

(1 point) 2. Suppose that A is a 5×3 matrix, and B is a matrix such that AB is defined. How many rows does B have?

Answer:

(1 point) 3. Suppose that $T : \mathbb{R}^3 \to \mathbb{R}^2$ is a linear transformation, and that

$$T\left(\begin{bmatrix}1\\0\\0\end{bmatrix}\right) = \begin{bmatrix}1\\-3\end{bmatrix},\ T\left(\begin{bmatrix}0\\1\\0\end{bmatrix}\right) = \begin{bmatrix}-2\\5\end{bmatrix},\text{ and } T\left(\begin{bmatrix}0\\0\\1\end{bmatrix}\right) = \begin{bmatrix}1\\1\end{bmatrix}.$$

Find $T\left(\begin{bmatrix}1\\2\\1\end{bmatrix}\right)$.

Answer:

(1 point) 4. Let $A = \begin{bmatrix}1 & 3\\-2 & 0\end{bmatrix}$ and $B = \begin{bmatrix}2 & -1\\-1 & 5\end{bmatrix}$. Calculate AB.

Answer:

(4 points) 5. Let $C = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & -1 \\ 0 & 1 & -2 \end{bmatrix}$. Determine whether or not C is invertible. If C is invertible, calculate C^{-1}. If C is not invertible, explain why not.

(4 points) 6. Find all values of a for which the vectors $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, $\begin{bmatrix} a \\ 1 \\ -a \end{bmatrix}$, $\begin{bmatrix} 1 \\ 2a \\ 3a+1 \end{bmatrix}$ are linearly independent.

(4 points) 7. Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation defined by $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} x + 2y \\ -3x + y \end{bmatrix}$, and let $S : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation with standard matrix $[S] = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$. Calculate $(T \circ S)\left(\begin{bmatrix} 3 \\ 5 \end{bmatrix}\right)$.

(4 points) 8. Suppose that $\mathbf{v}$ and $\mathbf{w}$ are vectors in $\mathbb{R}^n$. Show that $\mathbf{v}$ is in $\text{span}(2\mathbf{v}+\mathbf{w}, \mathbf{v}-\mathbf{w})$.

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[END]