Name: ________________________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 1 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^3 \to \mathbb{R}$ be the linear transformation given by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} x_3 + 3x_1 \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^3$ and $\mathbb{R}$.

Solution:

$$\begin{bmatrix} 3 & 0 & 1 \end{bmatrix}$$

□

A2. Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be given by $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} x+y \\ \sqrt{x}+\sqrt{y} \end{bmatrix}$. Determine if T is a linear transformation.

Solution:

$$T\left(\begin{bmatrix} 0 \\ 4 \end{bmatrix}\right) = \begin{bmatrix} 4 \\ 2 \end{bmatrix} \neq \begin{bmatrix} 4 \\ 4 \end{bmatrix} = 4T\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right)$$

So T is not a linear transformation.

□

M1. Let

$$C = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix} \qquad D = \begin{bmatrix} 3 & 1 & 0 \end{bmatrix} \qquad E = \begin{bmatrix} 2 & 0 \\ 0 & -1 \\ 1 & -1 \end{bmatrix}$$

Determine which of the six products CD, CE, DC, DE, EC, ED can be computed, and compute them.

Solution:

$$EC = \begin{bmatrix} 4 & 6 \\ 0 & -1 \\ 2 & 2 \end{bmatrix}$$

$$DE = \begin{bmatrix} 6 & -1 \end{bmatrix}$$

□

A1: ☐ **A2:** ☐ **M1:** ☐

Name: ______________________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 2 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^4 \to \mathbb{R}^2$ be the linear transformation given by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}\right) = \begin{bmatrix} x_1 + 3x_3 \\ 3x_2 - x_3 \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^4$ and $\mathbb{R}^2$.

Solution:

$$\begin{bmatrix} 1 & 0 & 3 & 0 \\ 0 & 3 & -1 & 0 \end{bmatrix}$$

□

A2. Determine if the map $T : \mathcal{P} \to \mathcal{P}$ given by $T(f) = f' - f''$ is a linear transformation or not.

M1. Let

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 0 & 0 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 1 & 7 & 7 \\ -1 & -2 & 0 & 4 \\ 0 & 0 & 1 & 5 \end{bmatrix} \qquad C = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$$

Determine which of the six products AB, AC, BA, BC, CA, CB can be computed, and compute them.

Solution: AB and CA are the only ones that can be computed, and

$$AB = \begin{bmatrix} -3 & -5 & 6 & 14 \\ 0 & 0 & 7 & 35 \end{bmatrix}$$

$$CA = \begin{bmatrix} 3 & 9 & 11 \\ 0 & 0 & 7 \end{bmatrix}$$

□

A1: ☐ **A2:** ☐ **M1:** ☐

Name: ____________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 3 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^3 \to \mathbb{R}^4$ be the linear transformation given by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} -3x + y \\ -8x + 2y - z \\ 2y + 3z \\ 7x \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^3$ and $\mathbb{R}^4$.

Solution:

$$\begin{bmatrix} 3 & 1 & 0 \\ -8 & 2 & -1 \\ 0 & 2 & 3 \\ 7 & 0 & 0 \end{bmatrix}$$

$\square$

A2. Determine if $D : \mathbb{R}^{2\times 2} \to \mathbb{R}$ given by $D\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = ad - bc$ is a linear transformation or not.

Solution: $D(I) = 1$ but $D(2I) = 4 \neq 2D(I)$, so D is not linear.

$\square$

M1. Let

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 0 & 0 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 1 & 7 & 7 \\ -1 & -2 & 0 & 4 \\ 0 & 0 & 1 & 5 \end{bmatrix} \qquad C = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$$

Determine which of the six products AB, AC, BA, BC, CA, CB can be computed, and compute them.

Solution: AB and CA are the only ones that can be computed, and

$$AB = \begin{bmatrix} -3 & -5 & 6 & 14 \\ 0 & 0 & 7 & 35 \end{bmatrix}$$

$$CA = \begin{bmatrix} 3 & 9 & 11 \\ 0 & 0 & 7 \end{bmatrix}$$

$\square$

A1: $\boxed{}$ **A2:** $\boxed{}$ **M1:** $\boxed{}$

Name: ______________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 4 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^3 \to \mathbb{R}$ be the linear transformation given by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} x_3 + 3x_1 \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^3$ and $\mathbb{R}$.

Solution:

$$\begin{bmatrix} 3 & 0 & 1 \end{bmatrix}$$

□

A2. Determine if the map $T : \mathcal{P}^6 \to \mathcal{P}^6$ given by $T(f) = f(x) - f(0)$ is a linear transformation or not.

M1. Let

$$C = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix} \qquad D = \begin{bmatrix} 3 & 1 & 0 \end{bmatrix} \qquad E = \begin{bmatrix} 2 & 0 \\ 0 & -1 \\ 1 & -1 \end{bmatrix}$$

Determine which of the six products CD, CE, DC, DE, EC, ED can be computed, and compute them.

Solution:

$$EC = \begin{bmatrix} 4 & 6 \\ 0 & -1 \\ 2 & 2 \end{bmatrix}$$

$$DE = \begin{bmatrix} 6 & -1 \end{bmatrix}$$

□

A1: ☐ **A2:** ☐ **M1:** ☐

Name: ____________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 5 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^3 \to \mathbb{R}^4$ be the linear transformation given by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} -3x + y \\ -8x + 2y - z \\ 2y + 3z \\ 7x \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^3$ and $\mathbb{R}^4$.

Solution:

$$\begin{bmatrix} 3 & 1 & 0 \\ -8 & 2 & -1 \\ 0 & 2 & 3 \\ 7 & 0 & 0 \end{bmatrix}$$

$\square$

A2. Determine if the map $T : \mathcal{P} \to \mathcal{P}$ given by $T(f) = f' - f''$ is a linear transformation or not.

M1. Let

$$A = \begin{bmatrix} 1 & 3 & -1 & -1 \\ 0 & 0 & 7 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 1 & 7 & 7 \\ -1 & -2 & 0 & 4 \\ 0 & 0 & 1 & 5 \end{bmatrix} \qquad C = \begin{bmatrix} 3 & 2 \\ 0 & 1 \\ -2 & -1 \end{bmatrix}$$

Determine which of the six products AB, AC, BA, BC, CA, CB can be computed, and compute them.

Solution: CA is the only one that can be computed, and

$$CA = \begin{bmatrix} 3 & 9 & 11 & 1 \\ 0 & 0 & 7 & 2 \\ -2 & -6 & -5 & 0 \end{bmatrix}$$

$\square$

A1: $\square$ **A2:** $\square$ **M1:** $\square$

Name: ________________________________

MASTERY QUIZ DAY 22 Math 237 – Linear Algebra
Version 6 Fall 2017

Show all work and justify all of your answers. Answers without work or sufficient reasoning will not receive credit. You may use a calculator, but you must show all relevant work to receive credit for a standard.

A1. Let $T : \mathbb{R}^3 \to \mathbb{R}$ be the linear transformation given by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} x_2 + 3x_3 \end{bmatrix}.$$

Write the matrix for T with respect to the standard bases of $\mathbb{R}^3$ and $\mathbb{R}$.

Solution:

$$\begin{bmatrix} 0 & 1 & 3 \end{bmatrix}$$

□

A2. Determine if $D : \mathbb{R}^{2\times 2} \to \mathbb{R}$ given by $D\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = a - 3c$ is a linear transformation or not.

M1. Let

$$C = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix} \qquad D = \begin{bmatrix} 3 & 1 & 0 \end{bmatrix} \qquad E = \begin{bmatrix} 2 & 0 \\ 0 & -1 \\ 1 & -1 \end{bmatrix}$$

Determine which of the six products CD, CE, DC, DE, EC, ED can be computed, and compute them.

Solution:

$$EC = \begin{bmatrix} 4 & 6 \\ 0 & -1 \\ 2 & 2 \end{bmatrix}$$

$$DE = \begin{bmatrix} 6 & -1 \end{bmatrix}$$

□

A1: ☐ **A2:** ☐ **M1:** ☐