

Homework 4

MATH 231

Due Wednesday, October 15, 2025

Instructions. *There will be no quiz on this assignment, but the content from the assignment will be on Exam 1.*

Exercise 1. Complete the following exercises from Section 1.8 in the course textbook:

1, 3, 5, 9, 11, 17, 19, 32, 38, 41

Exercise 2. Complete the following exercises from Section 1.9 in the course textbook:

1, 3, 4, 5, 6, 15, 17, 33, 37, 38, 39, 40, 44

Exercise 3. Complete the following exercises from Section 2.1 in the course textbook:

7–10, 12, 13, 25, 28, 29, 33, 35

Exercise 4. Suppose $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$ is a linear transformation such that $T(\mathbf{e}_1) = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$ and

$$T(\mathbf{e}_2) = \begin{bmatrix} -1 \\ -3 \\ 2 \end{bmatrix}.$$

(a) Find a formula for $T(\mathbf{x})$, that is, compute $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right)$.

(b) Find the standard matrix for T .

Exercise 5. Suppose $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ is a linear transformation such that

$$T\left(\begin{bmatrix} 1 \\ -3 \\ 7 \end{bmatrix}\right) = T\left(\begin{bmatrix} 5 \\ 2 \\ 0 \end{bmatrix}\right)$$

Find a nontrivial solution to $T(\mathbf{x}) = \mathbf{0}$.

Exercise 6. Suppose $T: \mathbb{R}^n \rightarrow \mathbb{R}^m$ is a linear transformation. Show that if $m > n$, then T cannot be onto.