

Last name _____

First name _____

LARSON—MATH 310—CLASSROOM WORKSHEET 11
Matrices.

Review: \mathbb{R} , *field*, *complex numbers*, \mathbb{R}^2 , \mathbb{K} , \mathbb{K}^n , *linear space* (or *vector space*), *subspace*, *linear map* (or *linear transformation*), *kernel*, *range*, *linear combination*, subspace *generated by* (or *spanned by*) a set of vectors, $\langle A \rangle$, *finite-dimensional vector space*, *linearly independent* set of vectors, *linearly dependent* set of vectors, *basis* of linear space, *dimension*, *rank* of a collection of vectors.

Review.

1. What is $M_{\mathbb{K}}(m, n)$?
2. How can we add two matrices?
3. How can we multiply a matrix by a scalar?
4. Why is $M_{\mathbb{K}}(m, n)$ a linear space?
5. Let A be a matrix with n columns. $A = [\vec{a}_1 \ \dots \ \vec{a}_n]$ and $\hat{x} = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}$. What is $A\hat{x}$?

From Chp. 4 of Tsukada, et al., Linear Algebra with Python

1. Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $\hat{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. What is $A\hat{x}$?

2. Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $\hat{x} = \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix}$. What is $A\hat{x}$?

3. If $A \in M_{\mathbb{K}}(m, n)$ and $B \in M_{\mathbb{K}}(n, p)$, how is AB defined?

4. Find

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

5. How can we calculate the $(2, 3)$ element of AB directly?

6. What is the (i, j) element of AB ? (What is a formula?)

Properties of Matrix Multiplication

7. Why is matrix multiplication *associative*?

8. Why does matrix multiplication *distribute* over addition?

9. Is matrix multiplication *commutative*?