

MA 351 Fall 2021 (Aaron N. K. Yip)

Homework 7

Due: Thursday, Oct. 28, in class

Penney, **Linear Algebra: Ideas and Applications** (4th edition)

p. 144: 2.66, 2.67, 2.76.

p. 92: 1.115, 1.116, 1.117, 1.118, 1.119, 1.120, 1.121.

1. Consider the following 3×5 matrix:

$$A = \begin{bmatrix} 1 & 2 & 0 & 1 & -1 \\ 3 & 0 & 1 & 1 & 7 \\ 1 & -4 & 1 & -1 & 9 \end{bmatrix}.$$

- Find the dimensions of $\text{Col}(A)$, $\text{Null}(A)$, and $\text{Row}(A)$.
- Find a basis for $\text{Col}(A)$, $\text{Null}(A)$, and $\text{Row}(A)$.
- Express each column of A as a linear combination of the basis vector of $\text{Col}(A)$ you have found in (b).
- Express each rows of A as a linear combination of the basis vector of $\text{Row}(A)$ you have found in (b).
- If you combine the basis vectors of $\text{Null}(A)$ and $\text{Row}(A)$, do they form a basis for R^5 ?
- Do the basis vectors of $\text{Col}(A)$ form a basis for R^3 ? If not, find some additional vector(s) so that combined together they do form a basis for R^3 .

2. Consider the following 3×4 matrix:

$$B = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 1 & 0 & 1 \\ -1 & 2 & 1 & 3 \end{bmatrix}.$$

- Find the dimensions of $\text{Col}(B)$, $\text{Null}(B)$, and $\text{Row}(B)$.
- Find a basis for $\text{Col}(B)$, $\text{Null}(B)$, and $\text{Row}(B)$.
- Express each column of B as a linear combination of the basis vector of $\text{Col}(B)$ you have found in (b).
- Express each rows of B as a linear combination of the basis vector of $\text{Row}(B)$ you have found in (b).
- If you combine the basis vectors of $\text{Null}(B)$ and $\text{Row}(B)$, do they form a basis for R^4 ?
- Do the basis vectors of $\text{Col}(B)$ form a basis for R^3 ? If not, find some additional vector(s) so that combined together they do form a basis for R^3 .