MTH 42 LECTURE NOTES (Ojakian)

Topic 13: Row and Column Spaces

OUTLINE
(References: 4.3)

1. Row and Column Spaces
2. Rank of a matrix
3. Rank-Nullity Theorem

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1. Row space and Column space and Rank

(a) See Definition 4.19.

PROBLEM 1. *Do exercise 1 on page 178 (wait on Rank-Nullity).*

PROBLEM 2. *How does the dimension of the row space relate to the dimension of the column space in the last problem? In general? Justify your answer and note Theorem 4.21*

(b) Definition 4.22

PROBLEM 3. *For exercise 1 above, what is the rank of the matrix?*

(c) Note: Column space = Range of corresponding linear transformation.

(d) Note: Row space does not correspond to something we have talked about (I think!)

2. Rank-Nullity Theorem

(a) Def: "Nullity" is the dimension of the Null Space

PROBLEM 4. *For exercise 1 above, what is the nullity of the matrix?*

PROBLEM 5. *For exercise 1, based on the rank and nullity, can you guess a theorem?*

(b) Theorem 4.23

(c) Restated:
Dimension of Null Space + Dimension of Range Space = Number of Columns.

PROBLEM 6. *Do exercises 13, 15, 17 on pages 178-179.*

PROBLEM 7. *Do exercise 7 on page 178.*