

Computer Project: Subspaces

Name _____

Purpose: to deepen your understanding of span, basis and dimension. In particular, to understand what is required for two subspaces of \mathbf{R}^n , which have the same dimension, to be the same sets.

Prerequisite: Section 2.9

MATLAB functions that may be useful: **rank**, **rref**, **diary**, **submats**

Remarks:

Your instructor will supply a pair of matrices A and B , each having five rows. (There are such pairs in the file **submats**, and you may be assigned one of those.)

Question 1 is easy, but you will need to think how to answer question 2. Discuss it with each other — this can really help. Once you figure out a method it will not take long to do the calculations. Observe that Col A and Col B are obviously subspaces of \mathbf{R}^5 .

Directions:

Use the matrices A and B which your instructor supplies. Employ MATLAB to do whatever calculations you need and attach the results. Explain your methods briefly and why they work. No credit unless your methods and explanation are valid!

One way to record your work is to just copy the key calculations by hand. An easier way is to create a diary file of your MATLAB session and print that after you finish all calculations.

If you want to create a diary file, here is a way: start MATLAB and type **diary c:subsp** before doing any calculations. This will cause everything that appears on the screen after that to be stored in a text file called `subsp` on your `c:` drive. When your calculations are finished, type **diary off** (or exit MATLAB) to close the file; then use your favorite editor to print the file `subsp`. If you want, you can first clean up the file, add titles, etc. before printing it.

1. Verify that Col A and Col B have the same dimension.
2. Determine whether or not Col A and Col B are the same subspace of \mathbf{R}^5 . Explain what you calculated and why it worked.

Notice this is not obvious. For example, if two subspaces of \mathbf{R}^3 each have dimension 1, each will be a line through the origin, but they might not be the same line. If each has dimension 2, they are planes through the origin, but they might not be the same plane. In general if two subspaces of \mathbf{R}^n have the same dimension k , we can visualize each as looking like \mathbf{R}^k -- but they might not be the same sets. Your job here is to figure out a way to decide if two subspaces of \mathbf{R}^n , which have the same dimension, are actually the same set of points, and apply your method to the subspaces Col A and Col B .