Chapter 4

Linear Combinations of Vectors in R^2

Definition: In R^2, **w** is a ***linear combination*** of **u** and **v** if there exists a and b such that w = a**u** + b**v**. I let **u**=(u_1, u_2), **v**=(v_1 v_2), and **w**=(w_1, w_2). **w** is a linear combination of **u** and v if I can solve the following two equations for a and b: au_1+ bv_1=w_1 and au_2+ bv_2 = w_2.

In matrix form this system is

$$\begin{pmatrix} u_1 & v_1 \\ u_2 & v_2 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} w_1 \\ w_2 \end{pmatrix}, \text{ or in augmented matrix form } \left(\begin{array}{cc|c} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \end{array}\right)$$

The rank of a matrix is the number of nonzero rows in a row echelon form of the matrix. Recall that this system has a unique solution iff the rank of the matrix of coefficients = 2. It has no solution if the rank of the matrix of coefficients is < 2 and rank of the augmented matrix = 2. It has many solutions if the rank of the matrix of coefficients and the augmented matrix are equal and less than two.

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Find the violations of good mathematical writing style in the above text and fix. If appropriate also use some enumeration of equations or formulas for ease of reference.