

## Exercises on the geometry of linear equations

**Problem 1.1:** (1.3 #4. *Introduction to Linear Algebra*: Strang) Find a combination  $x_1\mathbf{w}_1 + x_2\mathbf{w}_2 + x_3\mathbf{w}_3$  that gives the zero vector:

$$\mathbf{w}_1 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad \mathbf{w}_2 = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} \quad \mathbf{w}_3 = \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix}.$$

Those vectors are (independent)(dependent).

The three vectors lie in a plane. The matrix  $W$  with those columns is *not invertible*.

**Problem 1.2:** Multiply:  $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 4 & 1 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}.$

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 4 & 1 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \cdot 3 + 2 \cdot (-2) + 0 \cdot 1 \\ 2 \cdot 3 + 0 \cdot (-2) + 3 \cdot 1 \\ 4 \cdot 3 + 1 \cdot (-2) + 1 \cdot 1 \end{bmatrix} = \begin{bmatrix} -1 \\ 9 \\ 13 \end{bmatrix}$$

**Problem 1.3:** True or false: A 3 by 2 matrix  $A$  times a 2 by 3 matrix  $B$  equals a 3 by 3 matrix  $AB$ . If this is false, write a similar sentence which is correct.

m by p matrix times p by n matrix equals m by n matrix.

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