# Matrix-matrix mult.

## Chapter 2.1

composition of functions tells how one should mult. matrices...

$f(x) = Ax \qquad g(x) = Bx$

$(f \circ g)(x) = f(g(x)) = Ag(x) = A(Bx)$

It turn out comp. of lin. func. is another linear function. (Unlike comp. of sines is not another sine func).

This means $(f \circ g)(x)$ is linear and so there is a matrix $C$ such that

$$(f \circ g)(x) = Cx$$

We define $AB$ whatever it means so $AB = C$.

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How to multiply two matrices:

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ -1 & 0 & 8 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 0 & 3 \\ 1 & 2 & -1 \\ 2 & 4 & -5 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 0 & 3 \\ 1 & 2 & -1 \\ 2 & 4 & -5 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ -1 & 0 & 8 \end{bmatrix} \quad \begin{bmatrix} 9 & 16 & -14 \\ 9 & 18 & -21 \\ 15 & 32 & -43 \end{bmatrix} = AB$$

Note the number of rows in the prod. $AB$ is the same as ______ in $A$.

Note the number of cols. in the prod. $AB$ is the same as ______ in $B$.

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$$f(x) = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ -1 & 0 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} x_1 + 2x_2 + 3x_3 \\ x_2 + 4x_3 \\ -x_1 + 8x_3 \end{bmatrix}$$

$$g(x) = \begin{bmatrix} x_1 + 3x_3 \\ x_1 + 2x_2 - x_3 \\ 2x_1 + 4x_2 - 5x_2 \end{bmatrix}$$

$$(f \circ g)(x) = \begin{bmatrix} 9x_1 + 16x_2 - 14x_3 \\ 9x_1 + 18x_2 - 21x_3 \\ 15x_1 + 32x_2 - 43x_3 \end{bmatrix}$$