

# 16.1 Matrices

Goal: Solve systems of equations

Matrix: rectangular array

$$A = \begin{bmatrix} 1 & 4 & 9 \\ 2 & 6 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & -1 & 6 \\ 2 & 1 & 1 \end{bmatrix}$$

Size: (#rows) x (#columns)

A and B are 2x3

$$C = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$$

C is 3x1

Operations       $A+B = \begin{bmatrix} 2 & 3 & 15 \\ 4 & 7 & 1 \end{bmatrix}$

$$-2B = \begin{bmatrix} -2 & 2 & -12 \\ -4 & -2 & -2 \end{bmatrix}$$

Ex:  $2A - 6B = 2A + (-6B)$

$$= \begin{bmatrix} 2 & 8 & 18 \\ 4 & 12 & 0 \end{bmatrix} \quad \begin{bmatrix} -6 & 6 & -36 \\ -12 & -6 & -6 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & 14 & -18 \\ -8 & 6 & -6 \end{bmatrix}$$

$A+C$  is undefined (different sizes)

Ex: Solve for  $x$  and  $y$

$$a) \begin{bmatrix} x+3 & 7 \\ -4 & y-2 \end{bmatrix} = \begin{bmatrix} 9 & 7 \\ -4 & -7 \end{bmatrix}$$

$$x+3=9 \\ x=6$$

$$y-2=-7 \\ y=-5$$

$$b) \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ -9 \\ 8 \end{bmatrix}$$

NONSENSE Cannot solve

## 16.2 Matrix Multiplication

$$\text{Dot product} \quad [1 \ 3] \cdot \begin{bmatrix} 1 \\ 5 \end{bmatrix} = 1(1) + 3(5) \\ = 16$$

$$[1 \ 4 \ 1] \cdot \begin{bmatrix} -1 \\ 6 \\ 2 \end{bmatrix} = 1(-1) + 4(6) + 1(2) \\ = 25$$

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

$AB = \begin{bmatrix} r_1 \cdot c_1 & r_1 \cdot c_2 \\ r_2 \cdot c_1 & r_2 \cdot c_2 \end{bmatrix}$  Rows of 1st matrix  
Cols " 2nd "

$= \begin{bmatrix} -1 & 5 \\ -3 & 11 \end{bmatrix}$

$1(-1) + 2(0)$   
 $1(1) + 2(2)$   
 $3(1) + 4(2)$   
 $3(-1) + 4(0)$