

Matrix: Rectangular array of numbers

Ex: 
$$\begin{bmatrix} 4 & 3 & 2 \\ 1 & -5 & \frac{1}{2} \end{bmatrix}$$

rows x columns

$$2 \times 3$$

Scalar multiplication

multiplication of a constant

$$\text{Ex: } A = \begin{bmatrix} -5 & 10 \\ 7 & -12 \end{bmatrix}$$

$$\text{Find } -3A = \begin{bmatrix} 15 & -30 \\ -21 & 36 \end{bmatrix}$$

## Addition/subtraction of matrices

- ① matrices must be the same size
- ② Add or subtract entries in the same position

$$\text{Ex: } A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad B = \begin{bmatrix} -4 \\ -2 \\ -7 \end{bmatrix}$$

$$A - B = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} - \begin{bmatrix} -4 \\ -2 \\ -7 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 10 \end{bmatrix}$$

$$\begin{aligned} 3A + 2B &= 3 \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} + 2 \begin{bmatrix} -4 \\ -2 \\ -7 \end{bmatrix} \\ &= \begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix} + \begin{bmatrix} -8 \\ -4 \\ -14 \end{bmatrix} \\ &= \begin{bmatrix} -5 \\ 2 \\ -5 \end{bmatrix} \end{aligned}$$

## Solving systems of equations

Ex:

$$\begin{cases} 2x - 3y = 5 \\ x + 3y = -2 \end{cases} \rightarrow \begin{array}{c} \text{Augmented matrix} \\ \left[ \begin{array}{cc|c} 2 & -3 & 5 \\ 1 & 3 & -2 \end{array} \right] \\ \left[ \begin{array}{cc|c} 1 & 0 & 1 \\ 0 & 1 & -1 \end{array} \right] \end{array}$$

$x = 1$   
 $y = -1$

Solve:

$$\begin{cases} 4x + 8y - z = 10 \\ 3x - 8y + 9z = 14 \\ 5z + 7x - 6y = 0 \end{cases} \rightarrow \begin{array}{c} \left[ \begin{array}{ccc|c} 4 & 8 & -1 & 10 \\ 3 & -8 & 9 & 14 \\ 7 & 6 & 5 & 0 \end{array} \right] \\ \left[ \begin{array}{ccc|c} 1 & 0 & 0 & 24 \\ 0 & 1 & 0 & -13 \\ 0 & 0 & 0 & -6 \end{array} \right] \end{array}$$

$x = 24$   
 $y = -13$   
 $z = -18$