

# Addition and Scalar Multiplication

Addition and subtraction are **element-wise**, so you simply add or subtract each corresponding element:

$$\begin{bmatrix} a & bc & d \end{bmatrix} + \begin{bmatrix} w & xy & z \end{bmatrix} = \begin{bmatrix} a + w & b + xc + y & d + z \end{bmatrix}$$

Subtracting Matrices:

$$\begin{bmatrix} a & bc & d \end{bmatrix} - \begin{bmatrix} w & xy & z \end{bmatrix} = \begin{bmatrix} a - w & b - xc - y & d - z \end{bmatrix}$$

To add or subtract two matrices, their dimensions must be **the same**.

In scalar multiplication, we simply multiply every element by the scalar value:

$$\begin{bmatrix} a & bc & d \end{bmatrix} * x = \begin{bmatrix} a * x & b * xc * x & d * x \end{bmatrix}$$

In scalar division, we simply divide every element by the scalar value:

$$\begin{bmatrix} a & bc & d \end{bmatrix} / x = \begin{bmatrix} a/x & b/xc/x & d/x \end{bmatrix}$$

Experiment below with the Octave/Matlab commands for matrix addition and scalar multiplication. Feel free to try out different commands. Try to write out your answers for each command before running the cell below.

1 % Initialize matrix A and B

2 A = [1, 2, 4; 5, 3, 2]

3 B = [1, 3, 4; 1, 1, 1]

4

5 % Initialize constant s

6 s = 2

7

8 % See how element-wise addition works

9 add\_AB = A + B

10

11 % See how element-wise subtraction works

12 sub\_AB = A - B

13

14 % See how scalar multiplication works

15 mult\_As = A \* s

16

17 % Divide A by s

18 div\_As = A / s

19

20 % What happens if we have a Matrix + scalar?

21 add\_As = A + s

22

Run

Reset