Addition and Scalar Multiplication

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

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} a+w & b+x \\ c+y & d+z \end{bmatrix}$$

Subtracting Matrices:

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} - \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} a-w & b-x \\ c-y & d-z \end{bmatrix}$$

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

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

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

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

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

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

Mark as completed