Linear Algebra - Worksheet

Read this article before beginning the exercises: Linear Algebra Explained in 4 Pages

This assignment consists of 3 parts:

- Matrix Dimensions
- Vector Operations
- Matrix Operations

After completing the exercises by hand, use Python to check your work.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 7 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 5 & -1 \\ 9 & 1 \\ 6 & 0 \end{bmatrix} \quad D = \begin{bmatrix} 3 & -2 & -1 \\ 1 & 2 & 3 \end{bmatrix}$$

$$u = \begin{bmatrix} 6 & 2 & -3 & 5 \end{bmatrix} \quad v = \begin{bmatrix} 3 & 5 & -1 & 4 \end{bmatrix} \quad w = \begin{bmatrix} 1 \\ 8 \\ 0 \\ 5 \end{bmatrix}$$

1. Matrix Dimensions

Write the dimensions of each matrix.

1.1) A 2x3

1.2) B 2x2

1.3) C 3x2

1.4) D 2x3

1.5) u 4

1.6) w 4x1

---

2. Vector Operations

Perform the following operations. Assume $\alpha = 6$.

2.1) $\vec{u} + \vec{v} =$ (6,2,-3,5) + (3,5,-1,4) = (9,7,-4,9)

2.2) $\vec{u}$ - $\vec{v} =$ [3,-3,-2,1]

2.3) $\alpha\vec{u} =$ [36,12,-18,30]

2.4) $\vec{u} \cdot \vec{v} =$ 18+10+3+20 = 51

2.5) $\|\vec{u}\| =$ sqrt(36+4+9+25) = sqrt(74)

3. Matrix Operations

Evaluate each of the following expressions, if it is defined; else fill in with "not defined." Do your work by hand on scratch paper.

3.1) $A + C =$ not defined

3.2) $A - C^T =$ [[-4, -7,-3]
[3,6,4]]

CT = [[5,9,6], 3D = [[9,-6,-3],
[-1,1,0]] [3,6,9]]

3.3) $C^T + 3D =$ [[14,3,3],
[2,7,9]]

3.4) $BA =$ -1 -5 -1
2 7 4

3.5) $BA^T =$ not defined

Optional

3.6) $BC =$ not defined

3.7) $CB =$ 5 -6
9 -8
6 -6

3.8) $B^4 =$ B•B = 1 -2 •B = [1 -3 •B = [1 -4
0 1 0 1] 0 1]

3.9) $AA^T =$ 14 28
28 69

3.10) $D^T D =$ 10 -4 0
-4 8 8
0 8 10