

# COMPSCI.373 TUTORIAL 1 SOLUTIONS

## Vectors and Matrices

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## 1 Vector Representation

Exercise 1.a.

$$\begin{aligned} \text{magnitude} &= \sqrt{x^2 + y^2} \\ &= \sqrt{9 + 16} \\ &= 5 \end{aligned}$$

Exercise 1.b.

$$\begin{pmatrix} 3/5 \\ 4/5 \end{pmatrix}$$

Exercise 1.c. A 2 x 1 matrix ( 2 rows and 1 column)

## 2 Vector Arithmetic

Exercise 2.a.

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \\ 6 \end{pmatrix}$$

Exercise 2.b.

$$\begin{aligned} JK &= \begin{pmatrix} 2 \\ 2 \\ 2 \end{pmatrix} - \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \\ H &= 2 \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \end{aligned}$$

### 3 Matrix Multiplication

Exercise 3.a.

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \times \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 19 & 22 \\ 43 & 50 \end{pmatrix}$$

Exercise 3.b. No Solution

Exercise 3.c.

$$\begin{pmatrix} ax + by \\ cx + dy \end{pmatrix} = \begin{pmatrix} A.C \\ B.C \end{pmatrix}$$

### 4 Matrix Inverse

Exercise 4.a.

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}^{-1} = \frac{1}{1 \times 4 - 3 \times 2} \times \begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix} \\ = \begin{pmatrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{pmatrix}$$

### 5 Matrix Transpose

Exercise 5.a.

$$\begin{pmatrix} 1 & 4 \\ 5 & 6 \end{pmatrix} \times \begin{pmatrix} 2 & 3 \\ 1 & 5 \end{pmatrix} = \begin{pmatrix} 6 & 23 \\ 16 & 45 \end{pmatrix}$$

Exercise 5.b.

$$\begin{pmatrix} 6 & 16 \\ 23 & 45 \end{pmatrix}$$

Exercise 5.c.

$$\begin{pmatrix} 2 & 1 \\ 3 & 5 \end{pmatrix} \times \begin{pmatrix} 1 & 5 \\ 4 & 6 \end{pmatrix} = \begin{pmatrix} 6 & 16 \\ 23 & 45 \end{pmatrix}$$

Exercise 5.d. The matrices are the same which is consistent with the transpose identity:

$$(MT)^T = N^T M^T$$