EENG 428 Laboratory - Spring 2020

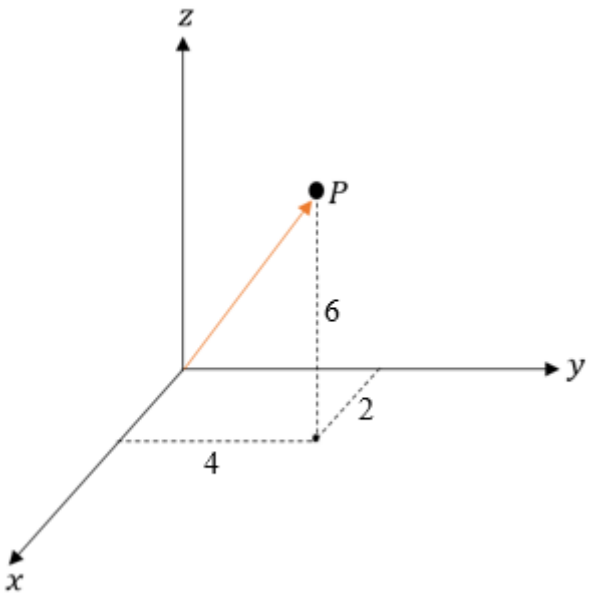
Lab Worksheet 1

Name: Student Number:

Exercise 1:

Represent the Point ***P*** in 3-D Cartesian Space as a vector using Cartesian Coordinates, Where $\hat{\imath}, \hat{\jmath}$ and $\hat{k}$ are the unit vectors along x, y and z axes respectively.

$$\boldsymbol{P} = \_\_\,\hat{\boldsymbol{\imath}} + \_\_\,\hat{\boldsymbol{\jmath}} + \_\_\,\hat{\boldsymbol{k}}$$



Find the length (magnitude) of a vector *P*

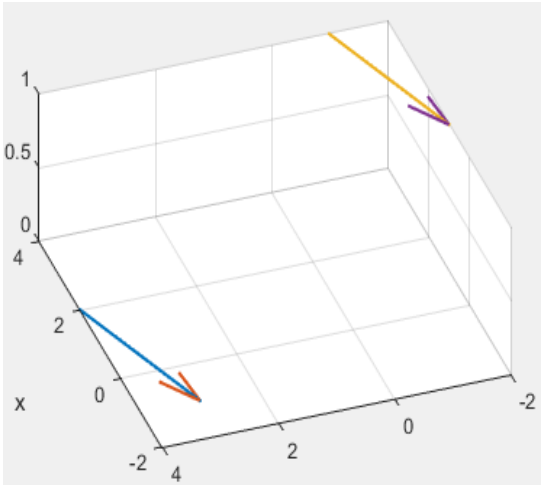
$$\|P\|_2 = \_\_\_\_\_$$

In order to represent the direction of the vector ***P,*** Normalize ***P*** to have unity length

Prepared by: Eyad Almasri
eyad.almasri@emu.edu.tr

Exercise 2:

Two vectors are equivalent if they have the same magnitude and direction. Consider the vector A drawn from point a_0 $(2,4,0)$ to point $a_1(-1,3,0)$ and the vector B drawn from Point $b_0(4,-1,1)$ to point $b_1(1,-2,1)$. Examine whether the Vectors A and B are Equivalent or not



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Exercise 3:

Consider the vectors

$$\boldsymbol{A} = \mathbf{1}\hat{\boldsymbol{\imath}} + \mathbf{2}\hat{\boldsymbol{\jmath}} + \mathbf{1}\hat{\boldsymbol{k}} \text{ and } \boldsymbol{B} = \mathbf{2}\hat{\boldsymbol{\imath}} + \mathbf{1}\hat{\boldsymbol{\jmath}} - \mathbf{1}\hat{\boldsymbol{k}}$$

1- Give a scaled representation for each of these vectors using the scalars 2 and 0.7

2- Find a unit vector to represent the direction of A and B

Exercise 4:

Consider the two vector

$$\boldsymbol{A} = 1\hat{\imath} + 1\hat{\jmath} + 0\hat{k} \text{ and } \boldsymbol{B} = 1.5\hat{\imath} + 0\hat{\jmath} + 0\hat{k}$$

Find the angle between the Vectors A and B using the dot product formula

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eyad.almasri@emu.edu.tr

Exercise 5:

Consider the vectors

$$\boldsymbol{A = 1\hat{\imath} + 2\hat{\jmath} + 1\hat{k}} \ , \ \boldsymbol{B = 2\hat{\imath} + 1\hat{\jmath} - 1\hat{k}} \text{ and } \boldsymbol{C = 2\hat{\imath} - 2\hat{\jmath} - 4\hat{k}}$$

Find the result of $(A \times B).(A - C)$

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Exercise 6:

Consider the system of linear equations

$$\begin{aligned} \mathbf{3}\,\boldsymbol{x_1} + \mathbf{4}\,\boldsymbol{x_2} + \mathbf{1}\,\boldsymbol{x_3} &= \mathbf{9} \\ \mathbf{1}\,\boldsymbol{x_1} + \mathbf{2}\,\boldsymbol{x_2} + \mathbf{9}\,\boldsymbol{x_3} &= \mathbf{2} \\ \mathbf{7}\,\boldsymbol{x_1} + \mathbf{1}\,\boldsymbol{x_2} + \mathbf{3}\,\boldsymbol{x_3} &= \mathbf{4} \\ \mathbf{4}\,\boldsymbol{x_1} + \mathbf{3}\,\boldsymbol{x_2} + \mathbf{2}\,\boldsymbol{x_3} &= \mathbf{7} \end{aligned}$$

Represent the System as the following matrix representation form

$$\boldsymbol{A\,x = b}$$

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Exercise 7:

Consider the system of linear equations

$$\begin{aligned} 3\,x_1 + 4\,x_2 &= 1 \\ 1\,x_1 + 2\,x_2 &= 2 \end{aligned}$$

Represent the System as the following matrix representation form

$$A\,x = b$$

Solve the following system by finding the inverse of the matrix A

Exercise 8:

Consider the system of linear equations

$$\begin{aligned} 1\,x_1 + 2\,x_2 + 3\,x_3 &= 1 \\ 1\,x_1 + 1\,x_2 + 2\,x_3 &= 2 \end{aligned}$$

Represent the System as the following matrix representation form

$$A\,x = b$$

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Exercise 9:

Solve the system in Exercise 8 by finding the **Moore-Penrose Pseudo Inverse** of the matrix A

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Exercise 10:

Consider the system of linear equations

$$\mathbf{1}\,x_1 + \mathbf{2}\,x_2 = \mathbf{1}$$
$$\mathbf{2}\,x_1 + \mathbf{4}\,x_2 = \mathbf{2}$$

Represent the System as the following matrix representation form

$$\boldsymbol{A\,x = b}$$

Solve the following system by finding the **Moore-Penrose Pseudo Inverse** of the matrix A

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