

Assignment 2

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Abstract—This document solves a problem based on the given point and a parallel vector.

Download all python codes from

<https://github.com/Adarsh1310/EE5609/tree/master/codes>

and latex-tikz codes from

<https://github.com/Adarsh1310/EE5609>

1 PROBLEM

Find the equation of a line which passes through $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and is parallel to vector $\begin{pmatrix} 3 \\ 2 \\ -2 \end{pmatrix}$.

2 EXPLANATION

A constant multiple of a vector points in the same direction and Hence it's convenient to find the line taking $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ as the starting point and following it with a constant multiple of the line parallel to the desired line.

Hence,

Equation of a line with a point with position vector \vec{a} and parallel to position vector \vec{b} will come to be :

$$\vec{r} = \vec{a} + k\vec{b}$$

Cartesian Equation :

Equation of a line passing through a point $\begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix}$

and parallel to $\begin{pmatrix} a \\ b \\ c \end{pmatrix}$ will be

$$\frac{x - x_1}{a} = \frac{y - y_1}{b} = \frac{z - z_1}{c} \quad (2.0.1)$$

3 SOLUTION

As explained in the previous section. Vectors will be as follows:

$$\vec{a} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$$\vec{b} = \begin{pmatrix} 3 \\ 2 \\ -2 \end{pmatrix}$$

Equation of the desired line in vector form will be:—

$$\vec{r} = \vec{a} + k\vec{b}$$

$$\vec{r} = (1\hat{i} + 2\hat{j} + 3\hat{k}) + k(3\hat{i} + 2\hat{j} - 2\hat{k})$$

Using Cartesian Equation

$$\frac{x - x_1}{a} = \frac{y - y_1}{b} = \frac{z - z_1}{c} \quad (3.0.1)$$

Here, $x_1 = 1, y_1 = 2, z_1 = 3, a = 3, b = 2, c = -2$

$$\frac{x - 1}{3} = \frac{y - 2}{2} = \frac{z - 3}{-2} \quad (3.0.2)$$