Matrix theory - Assignment2

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***Abstract*—This document illustrates equation of a line passing through a point and in direction of a vector**

Download all python codes from

https://github.com/shreeprasadbhat/matrix−theory/tree/master/assignment2/codes

and latex-tikz codes from

https://github.com/shreeprasadbhat/matrix−theory/blob/master/assignment2/

1 Problem

Find the equation of line which passes through the point $\begin{pmatrix}-2\\4\\5\end{pmatrix}$ and parallel to the line given by

$$\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6} \tag{1.0.1}$$

2 Construction

We know that equation of the line passing through given a point a and in a parallel to $\mathbf{b}$ is given by

$$\mathbf{r} = \mathbf{a} + \lambda\mathbf{b} \tag{2.0.1}$$

Also we can find direction vector from the Cartesian form of equation

$$\frac{x-x_1}{a} = \frac{y-y_1}{b} = \frac{z-z_1}{c} \tag{2.0.2}$$

This can be expressed as

$$\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}x_1\\y_1\\z_1\end{pmatrix} + \lambda\begin{pmatrix}a\\b\\c\end{pmatrix} \tag{2.0.3}$$

where $\mathbf{a} = \begin{pmatrix}x_1\\y_1\\z_1\end{pmatrix}$ is a point on given line and $\mathbf{b} = \begin{pmatrix}a\\b\\c\end{pmatrix}$ is the direction vector.

3 Solution

Writing given equation (1.0.1) in vector form as

$$\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}3\\-4\\8\end{pmatrix} + \lambda\begin{pmatrix}3\\5\\6\end{pmatrix} \tag{3.0.1}$$

So the direction vector of equation given is

$$\mathbf{b} = \begin{pmatrix}3\\5\\6\end{pmatrix} \tag{3.0.2}$$

and the point on which line passes is

$$\mathbf{P} = \begin{pmatrix}-2\\4\\5\end{pmatrix} \tag{3.0.3}$$

Substituting (3.0.2) and (3.0.3) in (2.0.1) we get

$$\mathbf{r} = \begin{pmatrix}-2\\4\\5\end{pmatrix} + \lambda\begin{pmatrix}3\\5\\6\end{pmatrix} \tag{3.0.4}$$

which is the line parallel to line (1.0.1) and passes through point $\begin{pmatrix}-2\\4\\5\end{pmatrix}$.

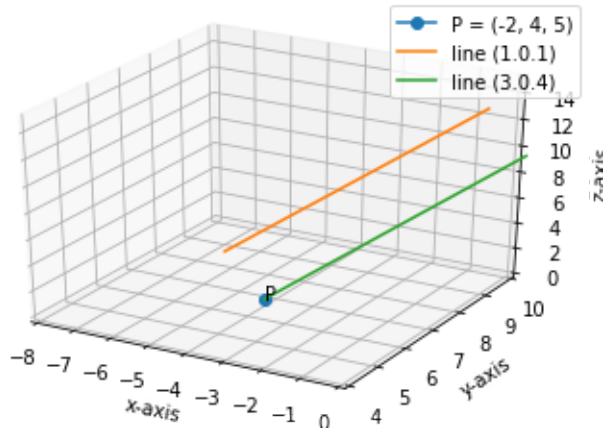

Fig. 0: Equation of line passing through point P and parallel to line (1.0.1)