

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

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

2 CONSTRUCTION

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

$$\mathbf{r} = \mathbf{a} + \lambda \mathbf{b} \quad (2.0.1)$$

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

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

This can be expressed as

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

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

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

So the direction vector of equation given is

$$\mathbf{b} = \begin{pmatrix} 3 \\ 5 \\ 6 \end{pmatrix} \quad (3.0.2)$$

and the point on which line passes is

$$\mathbf{P} = \begin{pmatrix} -2 \\ 4 \\ 5 \end{pmatrix} \quad (3.0.3)$$

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

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

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

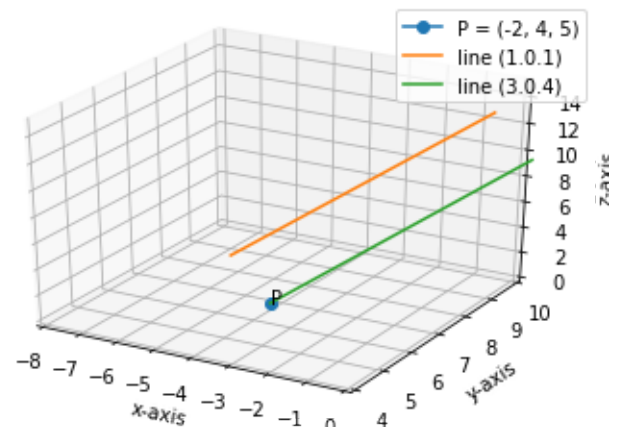


Fig. 0: Equation of line passing through point P and parallel to line (1.0.1)