Assignment 1

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Abstract—**This document explains how to find a line perpendicular to 2 lines and passing through a point.**

Download the python code from

and latex-tikz codes from

1 Problem

Find the vector equation of the line passing through the point $\begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}$ and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$

2 Solution

Equation of a line $\mathbf{l}$ passing through the point $\mathbf{a}$ and parallel to the line $\mathbf{n}$ is given by:

$$\mathbf{l} = \mathbf{a} + L\mathbf{n} \qquad (2.0.1)$$

where L is some constant. Since the line passes through $\begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}$, $\mathbf{a} = (1\ 2\ -4)\mathbf{x}$

Let $\mathbf{n}$ be the normal vector to both lines. If $\mathbf{m_1}$ and $\mathbf{m_2}$ are the direction vectors of the lines,then

$$\mathbf{m_1}^T\mathbf{n} = 0 \qquad (2.0.2)$$

$$\mathbf{m_2}^T\mathbf{n} = 0 \qquad (2.0.3)$$

Let $\mathbf{n} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$; $\mathbf{m_1} = \begin{pmatrix} 3 \\ -16 \\ 7 \end{pmatrix}$; $\mathbf{m_2} = \begin{pmatrix} 3 \\ 8 \\ -5 \end{pmatrix}$

Since $\mathbf{n}$ is perpendicular to $\mathbf{m_1}$ and $\mathbf{m_2}$

$$3x - 16y + 7z = 0 \qquad (2.0.4)$$

$$3x + 8y - 5z = 0 \qquad (2.0.5)$$

Solving the equations,

$$\frac{x}{2} = \frac{y}{3} = \frac{z}{6} = K \qquad (2.0.6)$$

$$x = 2K, y = 3K, z = 6K \qquad (2.0.7)$$

$$\mathbf{n} = K(236)\mathbf{x} \qquad (2.0.8)$$

So the equation of the required line is

$$\mathbf{l} = (124)\mathbf{x} + L(236)\mathbf{x} \qquad (2.0.9)$$

where L is any constant.

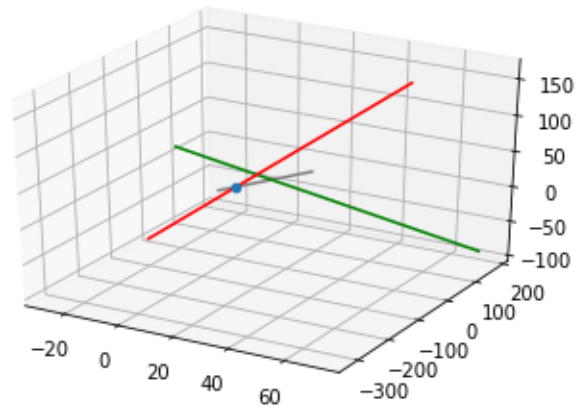$$\mathbf{l} = \begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix} + L\begin{pmatrix} 2 \\ 3 \\ 6 \end{pmatrix} \qquad (2.0.10)$$

Fig. 0: Perpendicular Line