Assignment 1

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

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

$$\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7} \text{ and } \frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{5}$$

2 SOLUTION

Equation of a $\overrightarrow{1}$ passing through $\overrightarrow{a}$ and parallel to $\overrightarrow{n}$ is given by:

$\overrightarrow{1} = \overrightarrow{a} + L * \overrightarrow{n}$, where L is some constant Since the line passes through $\begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}$

$\overrightarrow{a} = (i + 2j - 4k)$

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

$$\overrightarrow{m_1}^T \overrightarrow{n} = 0 \qquad (2.0.1)$$

$$\overrightarrow{m_2}^T \overrightarrow{n} = 0 \qquad (2.0.2)$$

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

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

$$3x - 16y + 7z = 0 \qquad (2.0.3)$$

$$3x + 8y - 5z = 0 \qquad (2.0.4)$$

Solving the equations $\frac{x}{2} = \frac{y}{3} = \frac{z}{6} = K$
$x = 2K, y = 3K, z = 6K$

$\overrightarrow{n} = K * (2i + 3j + 6k)$

so the equation of $\overrightarrow{1}$ is
$\overrightarrow{1} = (i + 2j - 4k) + L * K(2i + 3j + 6k)$,where L is any constant