

# 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

<https://github.com/AddagallaSatyanarayana/AI5006/tree/master/Assignment1>

and latex-tikz codes from

<https://github.com/AddagallaSatyanarayana/AI5006/blob/master/Assignment1/Assignment1.tex>

$$x = 2K, y = 3K, z = 6K$$

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

so the equation of  $\vec{l}$  is

$\vec{l} = (i + 2j - 4k) + L * K(2i + 3j + 6k)$ , where L is any constant

## 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  $\vec{l}$  passing through  $\vec{a}$  and parallel to  $\vec{n}$  is given by:

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

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

Let  $\vec{n}$  be the normal vector to both lines. If  $\vec{m}_1$  and  $\vec{m}_2$  are the direction vectors of the lines, then

$$\vec{m}_1^T \vec{n} = 0 \quad (2.0.1)$$

$$\vec{m}_2^T \vec{n} = 0 \quad (2.0.2)$$

$$\text{Let } \vec{n} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}; \vec{m}_1 = \begin{pmatrix} 3 \\ -16 \\ 7 \end{pmatrix}; \vec{m}_2 = \begin{pmatrix} 3 \\ 8 \\ -5 \end{pmatrix}$$

Since  $\vec{n}$  is perpendicular to  $\vec{m}_1$  and  $\vec{m}_2$

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

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

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

