4.5.7

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Question

The equation of a line, which is parallel to $2\hat{i}+\hat{j}+3\hat{k}$ and passes through the point $(5,-2,4)$ is

$$\frac{x-5}{2}=\frac{y+2}{-1}=\frac{z-4}{3}.$$

Solution

Let the point **h** and direction vector **m** be

$$\mathbf{h}=\begin{pmatrix}5\\-2\\4\end{pmatrix},\quad \mathbf{m}=\begin{pmatrix}2\\1\\3\end{pmatrix}.$$

The vector equation of the line is given by

$$\mathbf{x}=\mathbf{h}+\lambda\mathbf{m},\quad \lambda\in\mathbb{R}.$$

Expanding,

$$\mathbf{x}=\begin{pmatrix}5\\-2\\4\end{pmatrix}+\lambda\begin{pmatrix}2\\1\\3\end{pmatrix} \tag{1}$$

$$=\begin{pmatrix}5+2\lambda\\-2+\lambda\\4+3\lambda\end{pmatrix}. \tag{2}$$

Hence the parametric equations of the line are

$$x = 5 + 2\lambda, \tag{3}$$
$$y = -2 + \lambda, \tag{4}$$
$$z = 4 + 3\lambda, \quad \lambda \in \mathbb{R}. \tag{5}$$

Therefore, the symmetric form of the line is

$$\boxed{\frac{x-5}{2} = \frac{y+2}{1} = \frac{z-4}{3}}.$$

Which is different from the equation in the question:

$$\frac{x-5}{2} = \frac{y+2}{-1} = \frac{z-4}{3}$$

Hence, the statement:

The equation of a line, which is parallel to $2\hat{i} + \hat{j} + 3\hat{k}$ and passes through the point $(5, -2, 4)$ is $\frac{x-5}{2} = \frac{y+2}{-1} = \frac{z-4}{3}$ is False.

Plot

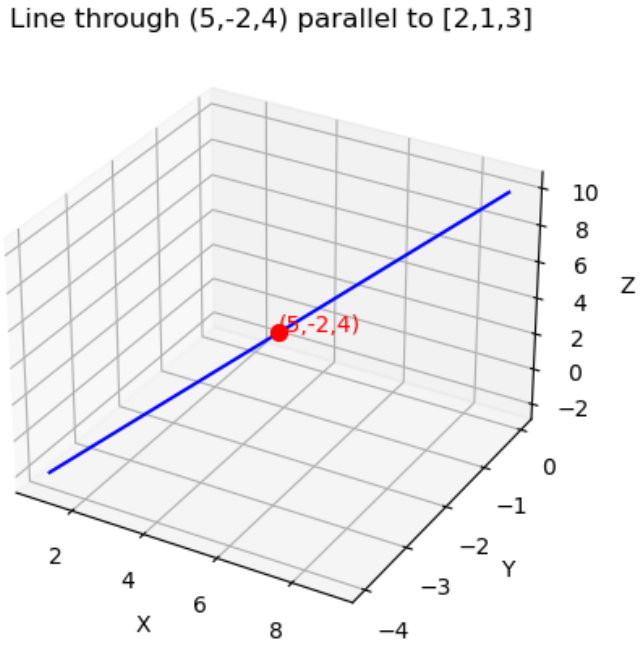

Figure 1: 3D plot of the line