

4.5.5

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October 4, 2025

Question

Find the vector equation of the line which is parallel to the vector $3\hat{i} - 2\hat{j} + 6\hat{k}$ and passes through the point $(1, -2, 3)$.

Theoretical Solution

The vector equation of a line is given by the formula:

$$\mathbf{x} = \mathbf{h} + t\mathbf{m}$$

where:

\mathbf{x} is the position vector of any point on the line, e.g., $\begin{pmatrix} x \\ y \\ z \end{pmatrix}$.

\mathbf{h} is the position vector of a known point on the line.

\mathbf{m} is the direction vector of the line.

t is a scalar parameter.

Theoretical Solution

From the problem statement, we identify the components: The line passes through the point $(1, -2, 3)$, so the position vector \mathbf{h} is:

$$\mathbf{h} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$$

The line is parallel to the vector $3\hat{i} - 2\hat{j} + 6\hat{k}$, so the direction vector \mathbf{m} is:

$$\mathbf{m} = \begin{pmatrix} 3 \\ -2 \\ 6 \end{pmatrix}$$

Theoretical Solution

Substituting \mathbf{h} and \mathbf{m} into the general equation $\mathbf{x} = \mathbf{h} + t\mathbf{m}$, we get the final answer. **The vector equation of the line is:**

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} + t \begin{pmatrix} 3 \\ -2 \\ 6 \end{pmatrix}$$

Plot of the Line:

3D Plot of the Vector Equation of a Line (Extended)

