Vector, Parametric and Cartesian Form of Straight Line

Convert the following **vector** equation of a line into **parametric** and **Cartesian** form

$$\boldsymbol{r} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 3 \\ 4 \end{pmatrix}$$

Vector Form

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 3 \\ 4 \end{pmatrix}$$

$$\begin{aligned} x &= 1 - 1\lambda \\ y &= -2 + 3\lambda \\ z &= 3 + 4\lambda \end{aligned}$$

Parametric Form

Rearrange the equations to make λ the subject

$$\begin{aligned} x &= 1 - 1\lambda \\ x - 1 &= -1\lambda \\ \frac{x-1}{-1} &= \lambda \end{aligned}$$

$$\begin{aligned} y &= -2 + 3\lambda \\ y + 2 &= 3\lambda \\ \frac{y+2}{3} &= \lambda \end{aligned}$$

$$\begin{aligned} z &= 3 + 4\lambda \\ z - 3 &= 4\lambda \\ \frac{z-3}{4} &= \lambda \end{aligned}$$

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

Cartesian Form

$$\begin{aligned} x &= 1 - 1\lambda \\ y &= -2 + 3\lambda \\ z &= 3 + 4\lambda \end{aligned}$$

Parametric Form

$$\boldsymbol{r} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 3 \\ 4 \end{pmatrix}$$

Vector Form