

**Question**

Find the intersection of the line  $x = 1 + 3t$ ,  $y = 2 + 4t$ ,  $z = 3 + 5t$  with the plane  $x + 2y + 3z = 6$ .

**Answer**

$$\left. \begin{array}{l} x = 1 + 3t \\ y = 2 + 4t \\ z = 3 + 5t \end{array} \right\} \text{intersection with } \left\{ \begin{array}{l} x + 2y + 3z = 6 \end{array} \right.$$

The intersection occurs when

$$\begin{aligned} & (1 + 3t) + 2(2 + 4t) + 3(3 + 5t) = 6 \\ & \Rightarrow 1 + 3t + 4 + 8t + 9 + 15t = 6 \\ & \Rightarrow 14 + 26t = 6 \\ \Rightarrow t &= \frac{6 - 14}{26} = -\frac{8}{26} = -\frac{4}{13} \end{aligned}$$

Thus the line intersects the plane when  $t = -\frac{4}{13}$

$$\begin{aligned} x &= 1 + 3\left(-\frac{4}{13}\right) = \frac{1}{13} \\ \Rightarrow y &= 2 + 4\left(-\frac{4}{13}\right) = \frac{10}{13} \\ z &= 3 + 5\left(-\frac{4}{13}\right) = \frac{19}{13} \end{aligned}$$