

Exercise 30

Find the equation of the line that passes through the point $(1, -2, -3)$ and is perpendicular to the plane $3x - y - 2z + 4 = 0$.

Solution

The equation for a line is

$$\mathbf{y}(t) = \mathbf{m}t + \mathbf{b},$$

where \mathbf{m} is the direction vector and \mathbf{b} is the position vector for any point the line goes through. The coefficients of x , y , and z give the normal vector to the plane, which also serves as the direction vector: $\mathbf{m} = (3, -1, -2)$. The position vector of the point that the line passes through is $(1, -2, -3)$.

$$\begin{aligned}\mathbf{y}(t) &= (3, -1, -2)t + (1, -2, -3) \\ &= (3t, -t, -2t) + (1, -2, -3) \\ &= (3t + 1, -t - 2, -2t - 3)\end{aligned}$$