

### Exercise 30

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

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#### 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  $(1, -2, -3)$ .

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