

## Exercise 28

Find an equation for the plane that passes through the point  $(2, -1, 3)$  and is perpendicular to the line  $\mathbf{v} = (1, -2, 2) + t(3, -2, 4)$ .

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### Solution

The equation for a plane is

$$\mathbf{n} \cdot (\mathbf{r} - \mathbf{r}_0) = 0,$$

where  $\mathbf{n}$  is a vector normal to the plane and  $\mathbf{r}_0$  is the position vector for any point in the plane. The direction vector of the line,  $(3, -2, 4)$ , serves as a normal vector to the plane, and  $(2, -1, 3)$  is the needed position vector.

$$(3, -2, 4) \cdot (x - 2, y + 1, z - 3) = 0$$

$$3(x - 2) - 2(y + 1) + 4(z - 3) = 0$$

$$3x - 6 - 2y - 2 + 4z - 12 = 0$$

$$3x - 2y + 4z = 20$$