

**Exercise 29**

Find an equation for the plane that passes through the point  $(1, 2, -3)$  and is perpendicular to the line  $\mathbf{v} = (0, -2, 1) + t(1, -2, 3)$ .

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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,  $(1, -2, 3)$ , serves as a normal vector to the plane, and  $(1, 2, -3)$  is the needed position vector.

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

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

$$x - 1 - 2y + 4 + 3z + 9 = 0$$

$$x - 2y + 3z = -12$$