

Exercise 15

In Exercises 13 to 19, use set theoretic or vector notation or both to describe the points that lie in the given configurations.

The line passing through $(-1, -1, -1)$ in the direction of \mathbf{j}

Solution

The equation for a line is

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

where \mathbf{m} is the direction vector, \mathbf{b} is the position vector for a point on the line, and t is a parameter. The vector \mathbf{j} can be written as $(0, 1, 0)$, so the line in question is

$$\begin{aligned}\mathbf{y}(t) &= (0, 1, 0)t + (-1, -1, -1) \\ &= (0, t, 0) + (-1, -1, -1) \\ &= (-1, t - 1, -1)\end{aligned}$$

Since there's only one arbitrary constant t , the line is one-dimensional. The set of points on the line is described by

$$\{(-1, t - 1, -1), t \in \mathbb{R}\}.$$