

## Exercise 17

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  $(-1, -1, -1)$  and  $(1, -1, 2)$

---

### 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. Subtract the two given position vectors to get  $\mathbf{m}$ .

$$\begin{aligned}\mathbf{m} &= (1, -1, 2) - (-1, -1, -1) \\ &= (2, 0, 3)\end{aligned}$$

So the line in question can be written as

$$\begin{aligned}\mathbf{y}(t) &= (2, 0, 3)t + (-1, -1, -1) \\ &= (2t, 0, 3t) + (-1, -1, -1) \\ &= (2t - 1, -1, 3t - 1)\end{aligned}$$

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

$$\{(2t - 1, -1, 3t - 1), t \in \mathbb{R}\}.$$