



**Definition**

Given two distinct points  $x \neq y$  in  $\mathbf{R}^n$ , the *line* through  $x$  and  $y$  is the set of points expressible as the sum of  $x$  and  $\alpha(y - x)$  where  $\alpha \in \mathbf{R}$ .

In other words, the line through  $x$  and  $y$  is

$$\{z \in \mathbf{R}^n \mid \exists \alpha \in \mathbf{R}, z = x + \alpha(y - x)\}.$$

Notice that if  $z = x + \alpha(x - y)$ , then

$$z = (1 - \alpha)x + \alpha y,$$

where  $\alpha \in \mathbf{R}$  and  $x, y \in \mathbf{R}^n$ .

**Notation**

We denote the line through  $x$  and  $y$  by  $L(x, y)$ .



