



## Why

We are constantly thinking of the elements of  $\mathbf{R}^2$  as points of a plane.<sup>1</sup>

## Discussion

We commonly associate elements of  $\mathbf{R}^2$  with points on a plane. (see Geometry).

**Principle 1** (Line Sets). *Given a plane, there exists a set of its (infinite) lines.*

**Principle 2** (Real Plane Correspondence). *Let  $L$  be the set of lines of a plane. Then  $\cup L$  is the set of points of the plane. There exists a one-to-one correspondence mapping elements of  $\cup L$  onto elements of  $\mathbf{R}^2$ .*

For this reason, we sometimes call elements of  $\mathbf{R}^2$  *points*. We call the point associated with  $(0,0)$  the *origin*. We call the element of  $\mathbf{R}^2$  which corresponds to a point the *coordinates* of the point.

## Visualization

To visualize the correspondence we draw two perpendicular lines. We then associate a point of the line with  $(0,0) \in \mathbf{R}^2$ . We can label it so. We then pick a unit length. And proceed as usual.<sup>2</sup>

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<sup>1</sup>Future editions will modify this sheet.

<sup>2</sup>Future editions will expand this.



Given that we have identified a plane with  $\mathbf{R}^2$  in this way, we call  $(x, y) \in \mathbf{R}^2$  the *coordinates* of the point it corresponds to. Many authors refer to this identification as a *Cartesian coordinate system* (or *Rectangular coordinate system*, *x-y coordinate system*).

