



## Why

We are constantly thinking of  $\mathbf{R}^3$  as points of space.<sup>1</sup>

## Definition

We commonly associate elements of  $\mathbf{R}^3$  with points in space. (see Geometry).

**Principle 1** (Plane Sets). *There exists a set of all planes.*

**Principle 2** (Real Space Correspondence). *Let  $P$  be the set of all planes of space. Then  $\cup P$  is the set of all lines and  $\cup \cup P$  is the set of all points. There exists a one-to-one correspondence mapping elements of  $\cup \cup P$  onto elements of  $\mathbf{R}^3$ .*

For this reason, we sometimes call elements of  $\mathbf{R}^3$  *points*. We call the point associated with  $(0, 0, 0)$  the *origin*. We call the element of  $\mathbf{R}^3$  which corresponds to a point the *coordinates* of the point.

## Visualization

To visualize the correspondence we draw three perpendicular lines. We call these *axes*. We then associate a point of the line with  $(0, 0, 0) \in \mathbf{R}^3$ . 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.



