



**Why**

We identified points in  $\mathbf{R}^2$  with elements of the plane in a natural way.<sup>1</sup>

**Definition**

Let  $(x, y) \in \mathbf{R}^2$ . Then  $(r, \theta) \in \mathbf{R}^2$  is the *polar form* or *circular form* of  $(x, y)$  if

$$x = r \cos \theta \quad \text{and} \quad y = r \sin \theta.$$

In this case we call  $r$  and  $\theta$  the *circular coordinates* or *polar coordinates*.

Since  $\sin$  and  $\cos$  polar coordinates are not unique.

**Non-uniqueness**

A difficult with polar coordinates is that there are many elements of  $\mathbf{R}^2$  that correspond to the same point in the plane. For example, consider the points

$$(5, \pi/3), (5, -5\pi/3), (-5, 4\pi/3), (-5, -2\pi/3).$$

Each of these specifies the same point in  $\mathbf{R}^2$ .

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<sup>1</sup>Future editions will expand on this in the genetic approach, and likely reference celestial motion.



