

# 9 Polar coordinates – Part 2

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

| English           | 中文  | Write it 3 times (English) |
|-------------------|-----|----------------------------|
| Polar coordinates | 极坐标 | _____                      |

## Recall

You locate points on a grid with  $(x, y)$  coordinates:

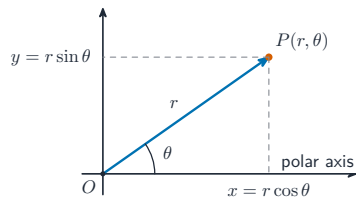
- $x$  is how far across,  $y$  is how far up.
- But you could also describe a point by its **distance** and **direction** from the centre.

Each idea has a worked example before the Practice.

## New ideas

### ■ 1 Polar coordinates

**Polar coordinates** 极坐标 locate a point by its distance  $r$  from the origin and its angle  $\theta$  from the positive  $x$ -axis – written  $(r, \theta)$ .



### ■ 2 Converting to x and y

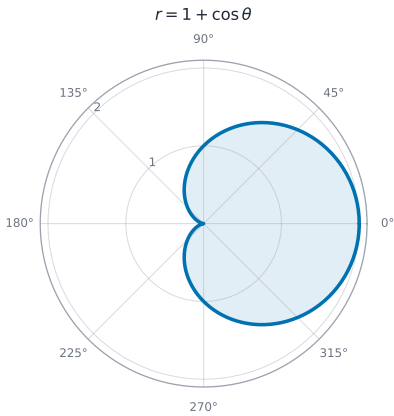
To convert polar to the usual coordinates:

$$x = r \cos \theta, \quad y = r \sin \theta.$$

*Worked example.* The polar point  $(2, 0^\circ)$  is  $x = 2 \cos 0^\circ = 2$ ,  $y = 2 \sin 0^\circ = 0$  – the point  $(2, 0)$ .

### ■ 3 Polar curves

Letting  $r$  depend on  $\theta$  traces a **polar curve** – often beautiful shapes like circles, spirals, and flower petals.



### ■ 4 Why use polar

Polar coordinates make round and rotating shapes much simpler to describe than  $x$ - $y$  coordinates do.

**Watch out:** in polar coordinates the first number is the **distance**  $r$  and the second is the **angle**  $\theta$  – not an  $x$  and a  $y$ . Reading  $(2, 90^\circ)$  as "across 2, up  $90^\circ$ " is wrong; it means "distance 2, angle  $90^\circ$ ".

## Practice

Try these in order. The methods are all above.

**2.1** State how polar coordinates locate a point.

[2]

**2.2** Write the formulas that convert polar  $(r, \theta)$  to  $x$  and  $y$ . [2]

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**2.3** Convert the polar point  $(3, 0^\circ)$  to  $x$ - $y$  coordinates. [2]

**2.4** Convert the polar point  $(4, 90^\circ)$  to  $x$ - $y$  coordinates ( $\cos 90^\circ = 0$ ,  $\sin 90^\circ = 1$ ). [3]

**2.5** State one advantage of polar coordinates. [1]

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