

THOMAS' CALCULUS (12/E)

11.4 Graphing in Polar Coordinates

開課班級: (105-2) 通訊1/電機1/智財學程 微積分

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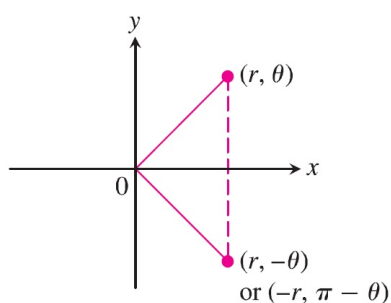
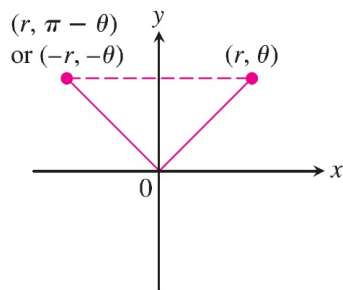
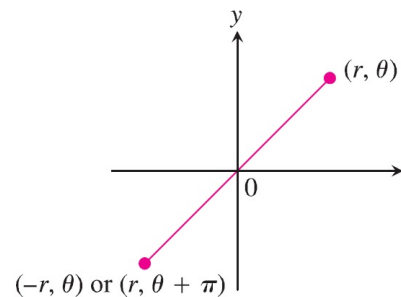
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1 Symmetry and Slope

1.1 Symmetry Tests for Polar Graphs

- (a) 1. Symmetry about the _____:
If the point (r, θ) lies on the graph, the point _____ or _____ lies on the graph.
- (b) 2. Symmetry about the _____:
If the point (r, θ) lies on the graph, the point _____ or _____ lies on the graph.
- (c) 3. Symmetry about the _____:
If the point (r, θ) lies on the graph, the point _____ or _____ lies on the graph.

(a) About the x -axis(b) About the y -axis

(c) About the origin

1.2 Slope

The slope of a polar curve $r = f(\theta)$ is given by _____, not by _____.

1.3 Slope of the Curve $r = f(\theta)$

$$\left. \frac{dy}{dx} \right|_{(r,\theta)} = \underline{\hspace{4cm}}, \text{ provided } dy/d\theta \neq 0 \text{ at } (r, \theta).$$


1.4 Consider the graph of f as the graph of the parametric equations $x = r \cos \theta = f(\theta) \cos \theta, y = r \sin \theta = f(\theta) \sin \theta$.
 $\frac{dy}{dx} =$

1.5 If the curve $r = f(\theta)$ passes through the origin at $\theta = \theta_0$, then $f(\theta_0) = 0$ and the slope equation gives

$$\left. \frac{dy}{dx} \right|_{(0,\theta_0)} = \underline{\hspace{4cm}}$$


1.6 If the graph of $r = f(\theta)$ passes through the origin at $\theta = \theta_0$ the value the slope of the curve there is $\underline{\hspace{2cm}}$.

1.7 The reason we say $\underline{\hspace{4cm}}$ and not just $\underline{\hspace{4cm}}$ is that a polar curve may pass through the origin (or any point) $\underline{\hspace{4cm}}$, with different slopes at different.

 **Ex. 1** (example1, p632)


Graph the curve $r = 1 - \cos \theta$.

sol:

 **Ex. 2** (example2, p633)

Graph the curve $r^2 = 4 \cos \theta$.

sol:

 **Ex. 3** (example3, p3)722

Graph the curve $r^2 = \sin 2\theta$.

sol:

2 重要極座標圖形

2.1 圓 circle

$r = a \cos \theta$		$r = a \sin \theta$	
$a < 0$	$a > 0$	$a < 0$	$a > 0$

2.2 心臟線 Cardioid

$r = a(1 \pm \cos \theta)$		$r = a(1 \pm \sin \theta)$	
$a < 0$	$a > 0$	$a < 0$	$a > 0$

2.3 蚌線 LimaCon

$r = a \pm b \cos \theta$		$r = a \pm b \sin \theta$	
$a > b$	$a < b$	$a > b$	$a < b$

2.4 雙紐線 Lemniscates

$r^2 = a^2 \cos 2\theta$	$r^2 = a^2 \sin 2\theta$

2.5 玫瑰線 Rose curve

$r = a \cos n\theta$		$r = a \sin n\theta$	
$n : \text{odd}$	$n : \text{even}$	$n : \text{odd}$	$n : \text{even}$

實習課練習 (EXERCISE 11.4)

2. Graph the curve $r = 2 - 2 \cos \theta$.
6. Graph the curve $r = 1 + 2 \sin \theta$.
13. Graph the curve $r^2 = 4 \cos 2\theta$.
19. Graph the curve $r = \sin 2\theta$.