# 10.4 Graphing Polar Coordinate Equations
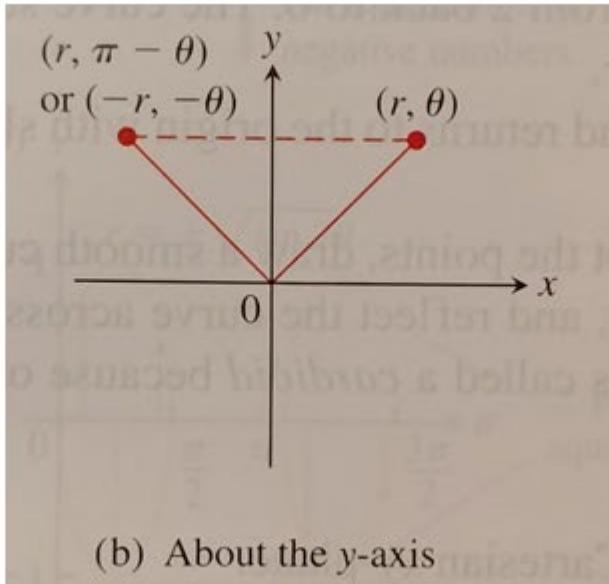
師大工教一

Symmetry Tests for Polar Graphs in the Cartesian $xy-$ Plane
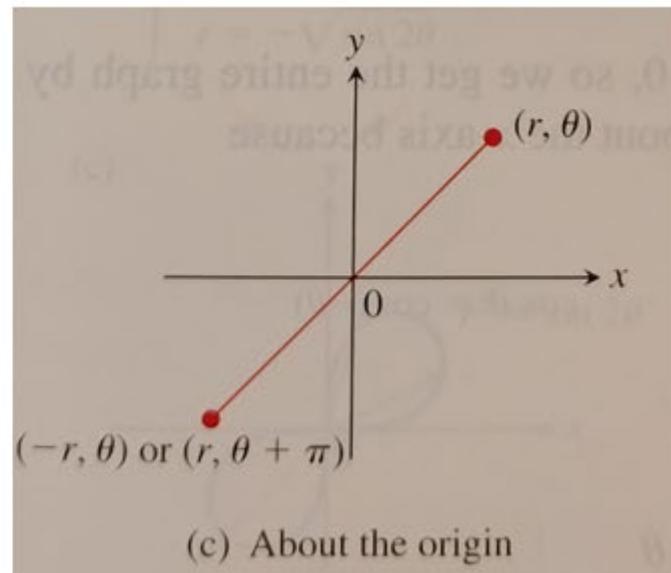
1. Symmetry about the $x-$ axis: If the point (r,θ) lies on the graph, then the

point $(r,-\theta)$ or $(-r,\pi-\theta)$ lies on the graph.

2. Symmetry about the $y-$ axis: If the point (r,θ) lies on the graph, then the

point $(-r,-\theta)$ or $(r,\pi-\theta)$ lies on the graph.

3. Symmetry about the origin: If the point (r,θ) lies on the graph, then the

point $(-r,\theta)$ or $(r,\pi+\theta)$ lies on the graph.

(a) About the x-axis

(b) About the y-axis

(c) About the origin
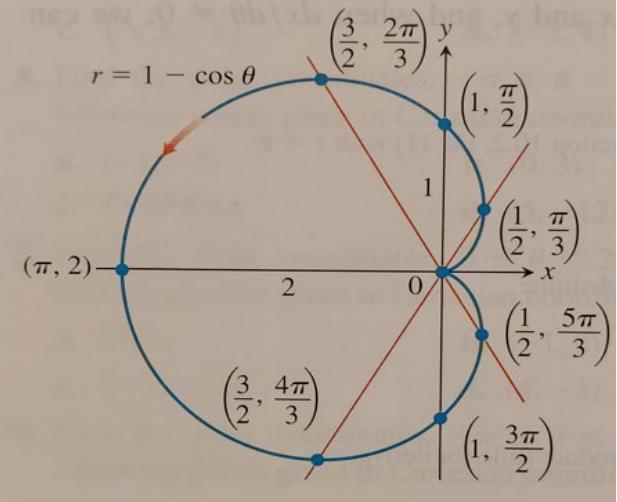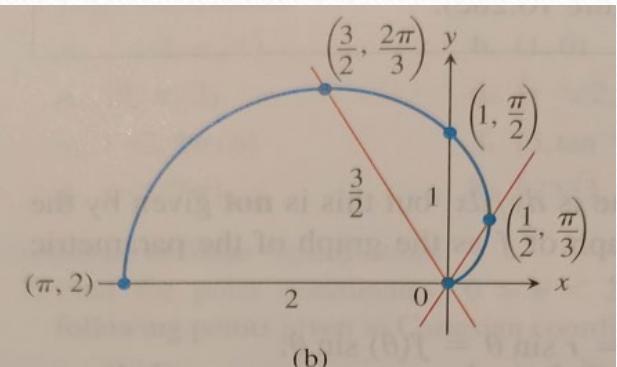
Slope of the Curve $r = f(\theta)$ **in the Cartesian** $xy - $ **Plane**

$$x = r\cos\theta = f(\theta)\cos\theta, \; y = r\sin\theta = f(\theta)\sin\theta$$

$$\frac{dy}{dx} = \frac{\dfrac{dy}{d\theta}}{\dfrac{dx}{d\theta}} = \frac{f'(\theta)\sin\theta + f(\theta)\cos\theta}{f'(\theta)\cos\theta - f(\theta)\sin\theta}$$
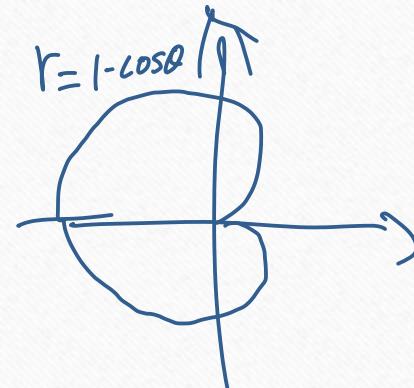
**Ex1(p622)** Graph the curve $r = 1 - \cos\theta$ in the Cartesian xy - plane.

θ	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π
$1 - \cos\theta$	0	$1-\frac{\sqrt{3}}{2}$	$1-\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	1	$\frac{3}{2}$	$1+\frac{\sqrt{2}}{2}$	$1+\frac{\sqrt{3}}{2}$	2
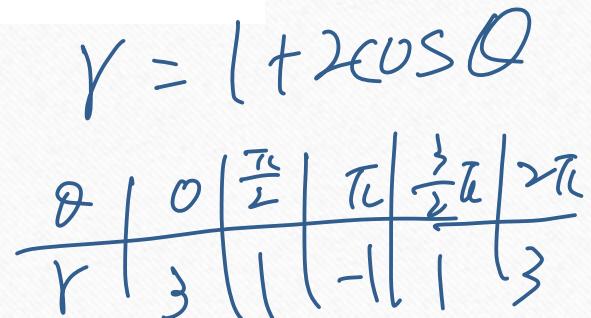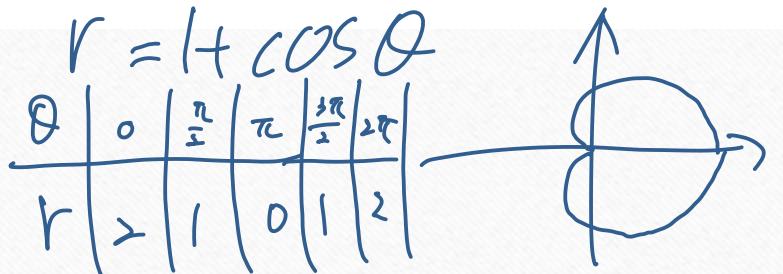
| $\frac{7\pi}{6}$	$\frac{5}{4}\pi$	$\frac{4}{3}\pi$	$\frac{2}{3}\pi$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
$1+\frac{\sqrt{3}}{2}$	$1+\frac{\sqrt{2}}{2}$	$\frac{3}{2}$	1	$\frac{1}{2}$	$1-\frac{\sqrt{2}}{2}$	$1-\frac{\sqrt{3}}{2}$	0

$r = 1 \pm \cos\theta$
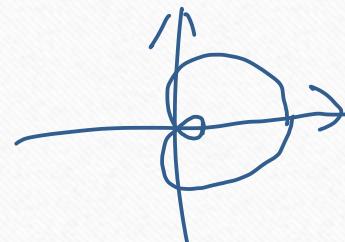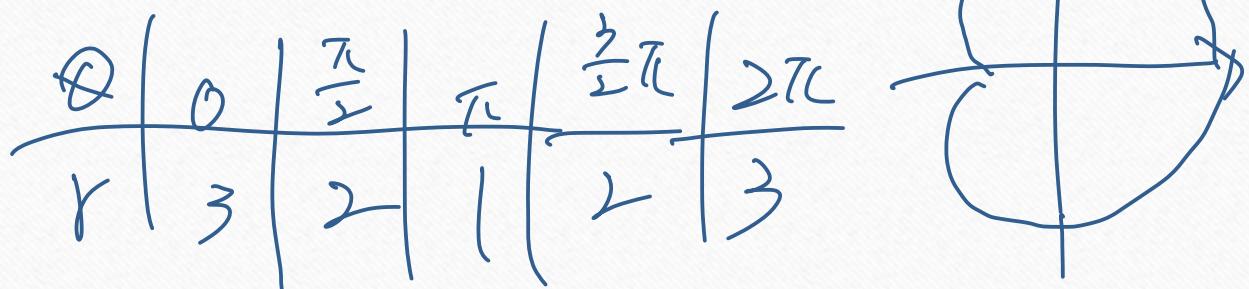
$r = 1 \pm \sin\theta$

$r = 1 - \cos\theta$

**Supplement: Graph** $r = 1 + \cos\theta, r = 2 + \cos\theta, r = 1 + 2\cos\theta$.

$r = 1 + \cos\theta$

θ	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
r	2	1	0	1	2

$r = 2 + \cos\theta$

θ	0	$\frac{\pi}{2}$	π	$\frac{3}{2}\pi$	2π
r	3	2	1	2	3

$r = 1 + 2\cos\theta$

θ	0	$\frac{\pi}{2}$	π	$\frac{3}{2}\pi$	2π
r	3	1	-1	1	3

HW10-4

- **HW: 1,5,6**