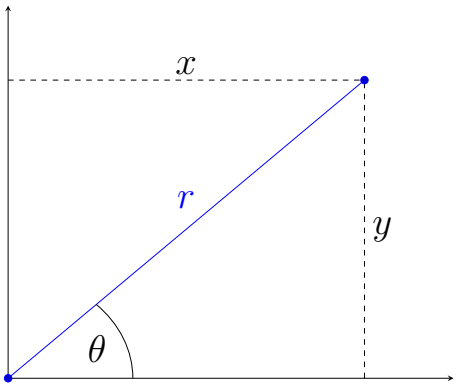
Polar Coordinates



Usual conventions are either $-\pi < \theta \leqslant \pi$ or $0 \leqslant \theta < \pi$

$x = r\cos\theta$
$y = r\sin\theta$
$r^2 = x^2 + y^2$
$\theta = \arctan\left(\frac{y}{x}\right)$

1 Converting between polar and Cartesian form

1.1 Example 1

Find the Cartesian equation of: $r = 5$

$$\sqrt{x^2 + y^2} = 5$$
$$x^2 + y^2 = 25$$

1.2 Example 2

Find the Cartesian equation of:

$$r = 2 + \cos 2\theta$$

Replace r and convert $\cos 2\theta$

$$\sqrt{x^2 + y^2} = 2 + \cos^2\theta - \sin^2\theta$$

Convert $\sin^2\theta$ and $\cos^2\theta$

$$\sqrt{x^2 + y^2} = 2 + \frac{x^2}{x^2 + y^2} - \frac{y^2}{x^2 + y^2}$$

Multiply all terms by $x^2 + y^2$

$$(x^2 + y^2)^{\frac{3}{2}} = 3x^2 + y^2$$