10.3 Polar Functions

Polar Points: (r, θ)

directed distance from the pole

directed angle measured from the polar axis

$(2, 30°)$

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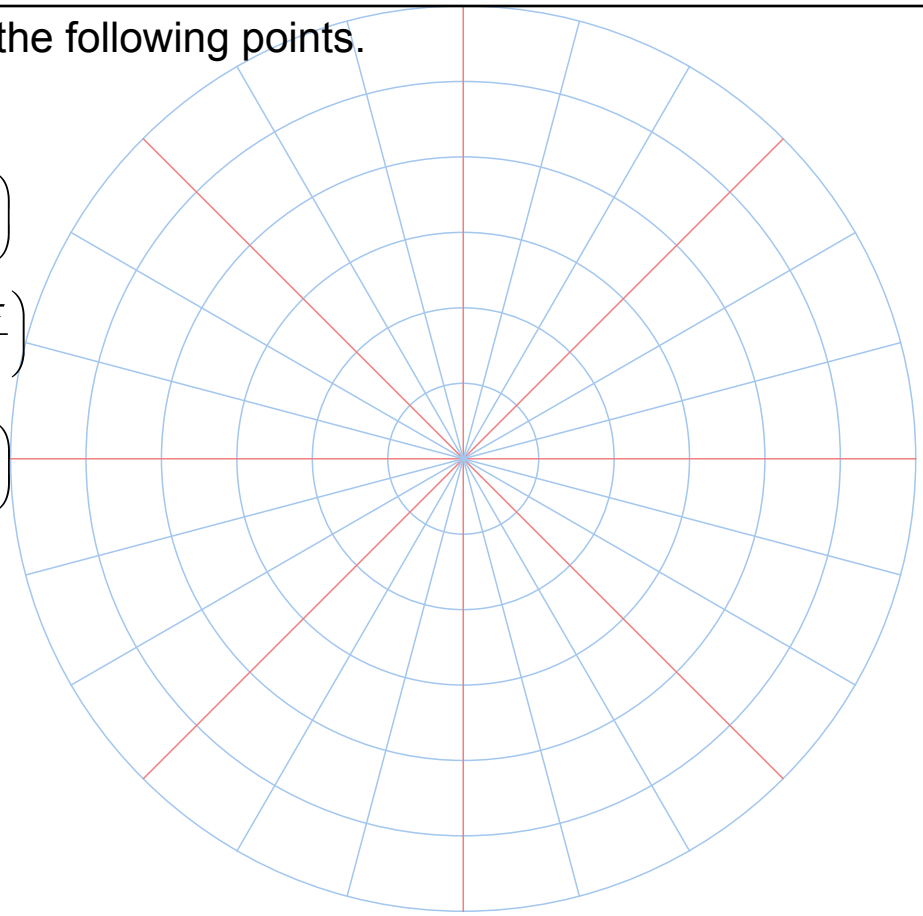
Graph the following points.

$\left(4, \frac{5\pi}{3}\right)$

$\left(-3, \frac{3\pi}{4}\right)$

$\left(1, -\frac{\pi}{6}\right)$



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Conversion: Rectangular to Polar

$$(x, y) \rightarrow (r, \theta)$$

Conversion: Polar to Rectangular

$$(r, \theta) \rightarrow (x, y)$$

$$x^2 + y^2 = r^2$$

$$\cos\theta = \frac{x}{r} \qquad x = r\cos\theta$$

$$\sin\theta = \frac{y}{r} \qquad y = r\sin\theta$$

$$\tan\theta = \frac{y}{x}$$

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Give the polar coordinates for:

(2, 2)

(3, -3)

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Give the rectangular coordinates for:

$$\left(2, \frac{5\pi}{6}\right)$$

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Conversions with Polar Equations

to convert equations use:

$$x = r\cos\theta \qquad y = r\sin\theta \qquad x^2 + y^2 = r^2$$

and other identities as needed

y = 4

$$2x^2 + 2y^2 = 25$$

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$r\sin\theta = 3$ $r = 2\cos\theta$ $\theta = \frac{\pi}{6}$

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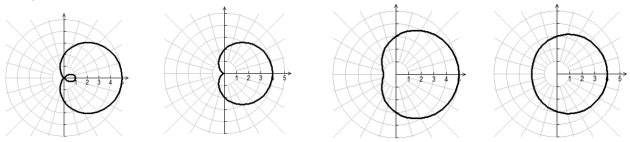
Limaçons

$r = a \pm b\cos\theta$

$r = a \pm b\sin\theta$

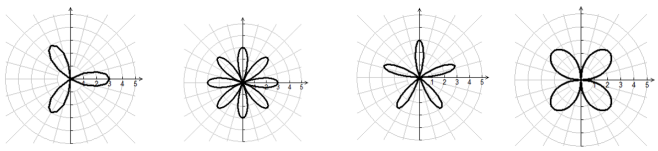
$a > 0, b > 0$



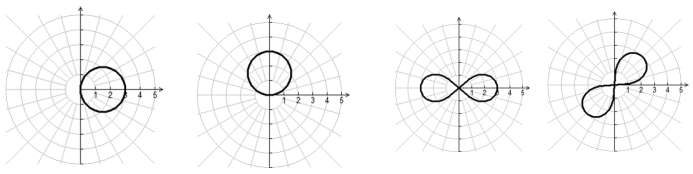
Rose Curves

n petals if n is odd
2n petals if n is even

$n \geq 2$



Circles and Lemniscates



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Calculus with Polar Equations

$x = r\cos\theta$

$y = r\sin\theta$

slope: $\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}$ Or $\frac{dy}{dx} = \frac{r'\sin\theta + r\cos\theta}{r'\cos\theta - r\sin\theta}$

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Find $\frac{dy}{dx}$ and the slope of the graph at the given value:

$r = 3 + 2\sin\theta$ $\theta = \frac{\pi}{6}$

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