11.2 Polar Basics

Essential Question

How do I convert points to polar form?

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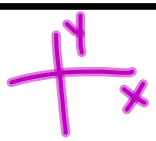
Polar Coordinates and Polar Graphs

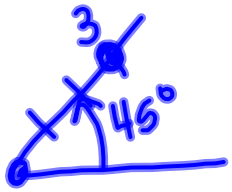
Rectangular coordinates are in the form (x, y).



Polar Coordinates are in the form (r, θ).

radius angle

center : pole



ex. $(3, 45°)$

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Example 1. Graph the following polar coordinates:

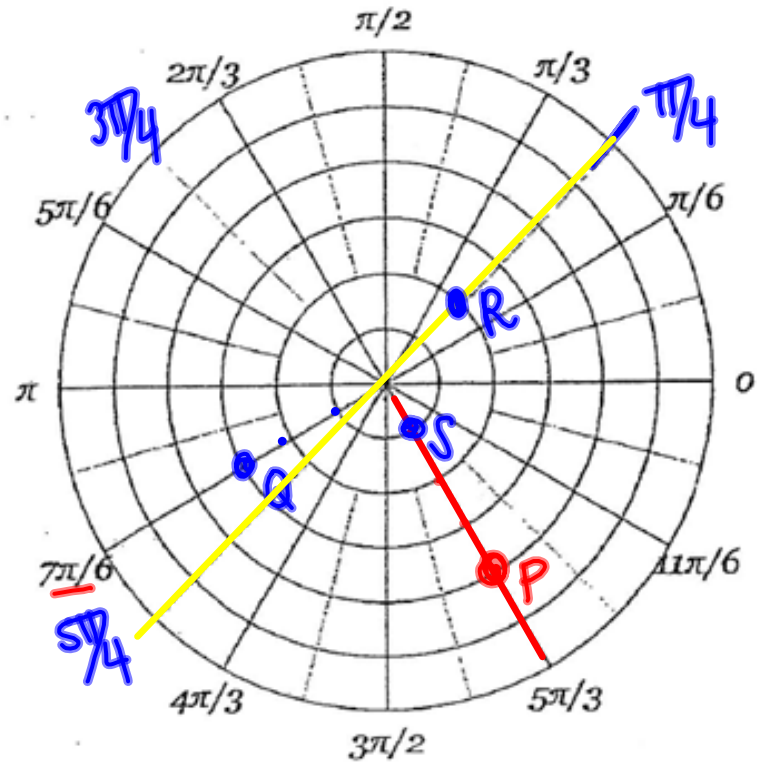
P $\left(4, \frac{5\pi}{3}\right)$

Q $\left(3, \frac{7\pi}{6}\right)$

R $\left(-2, \frac{5\pi}{4}\right)$

Neg. radius → backwards

S $\left(1, -\frac{\pi}{3}\right)$



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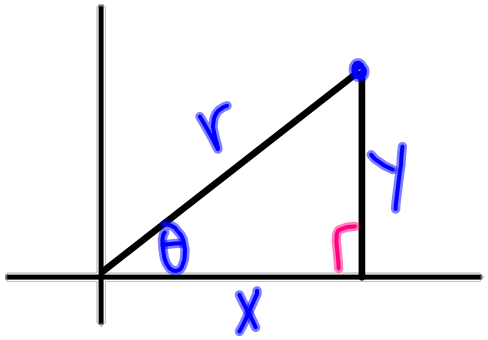

Earlier we learned that...

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

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

convert from Polar → Rect.

so $x = r\cos\theta$

so $y = r\sin\theta$

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

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

convert from Rect → Polar

so $r = \sqrt{x^2+y^2}$

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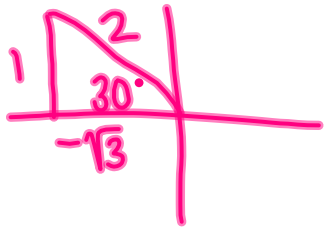
Example 2. Convert $\left(4, \frac{5\pi}{6}\right)$ to rectangular coordinates. $\boxed{(-2\sqrt{3}, 2)}$

r θ

$x = 4\cos\frac{5\pi}{6}$

$x = 4\left(\frac{-\sqrt{3}}{2}\right)$

$x = -2\sqrt{3}$



$y = 4\sin\frac{5\pi}{6}$

$y = 4\left(\frac{1}{2}\right)$

$y = 2$

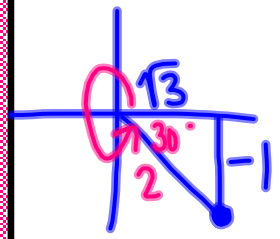
Example 3. Convert to polar coordinates GRAPH! $0 \le \theta < 2\pi$

a. $(\sqrt{3}, -1)$

$\tan\theta = \frac{y}{x} = \frac{-1}{\sqrt{3}}$

$\theta = \tan^{-1}\left(-\frac{1}{\sqrt{3}}\right)$

$\theta = \frac{11\pi}{6}$



$r = \sqrt{x^2 + y^2}$

$r = \sqrt{(\sqrt{3})^2 + (-1)^2}$

$\boxed{\left(2, \frac{11\pi}{6}\right)}$

b. $(0, -2)$

$\theta = \frac{3\pi}{2}$

$\boxed{\left(2, \frac{3\pi}{2}\right)}$

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Example 4. Convert the following equations to polar form.

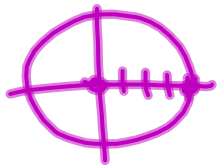
a. $x = 3$

$r\cos\theta = 3$

$r = \frac{3}{\cos\theta} = 3\sec\theta$

b. $x^2 + y^2 = 16$

circle



$r^2 = 16$

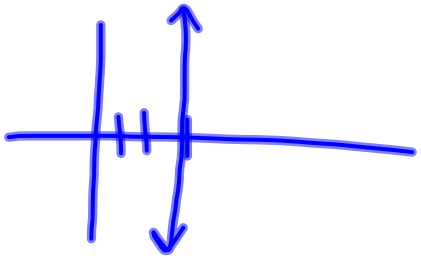
$r = 4$

radius is always 4

Example 5. Convert the following equation to rectangular form and sketch the graph.

a. $r\cos\theta = 3$

$x = 3$



b. $\theta = \frac{\pi}{3}$

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

$\tan\theta = \tan\frac{\pi}{3}$

$x \cdot \frac{y}{x} = \frac{\sqrt{3}}{1} \cdot x$

$y = \sqrt{3}x$

slope