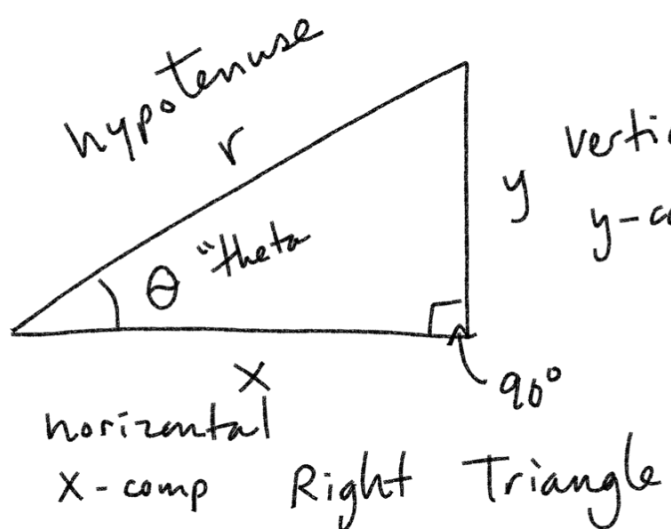




vertical and
horizontal
component

Trigonometric Ratios



$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$
SOH

$r (\sin \theta) = \left(\frac{y}{r} \right) r$

$y = r \sin \theta$

$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
CAH

$r (\cos \theta) = \left(\frac{x}{r} \right) r$

$x = r \cos \theta$

$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{y}{r}}{\frac{x}{r}}$

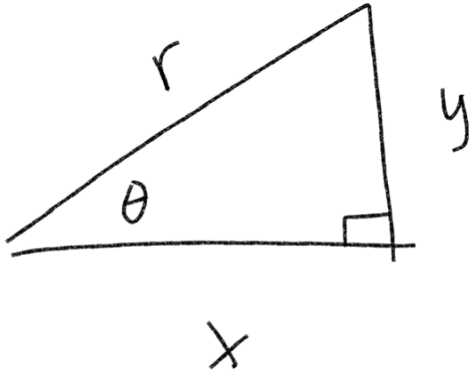
$\tan \theta = \frac{y}{x}$

TOA
 $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$

$\frac{y}{r} \div \frac{x}{r} = \frac{y}{x}$

SOH CAH TOA

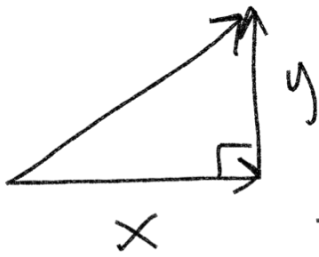
Pythagorean Theorem



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

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

(r, θ) polar coordinate



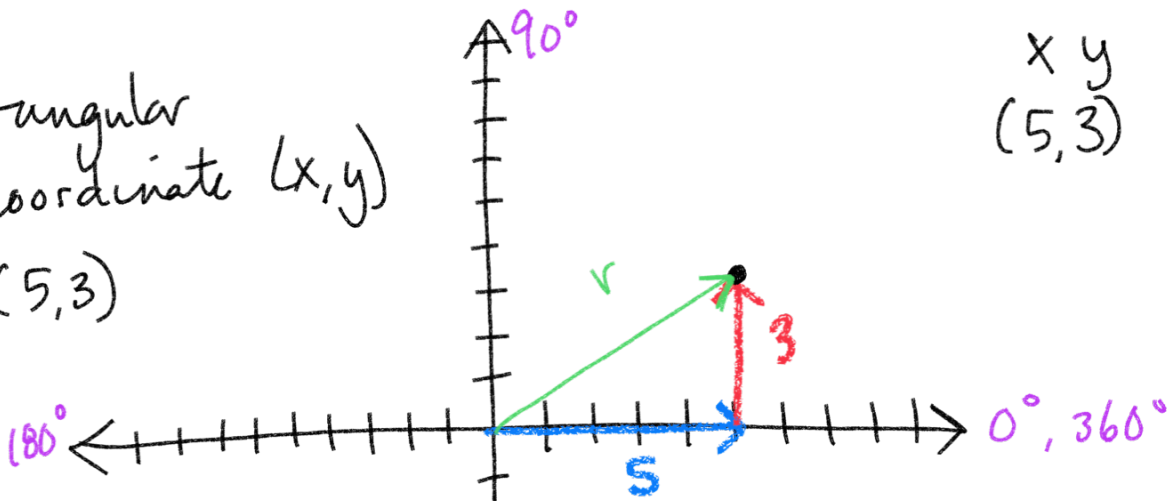
$$\vec{x} + \vec{y} = \vec{r}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

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

Rectangular
Coordinate (x, y)
 $(5, 3)$

x y
 $(5, 3)$



Polar
Coordinate (r, θ)

vector
magnitude $\rightarrow r$
direction $\rightarrow \theta$

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

$$r = \sqrt{(5)^2 + (3)^2}$$

$$r = \sqrt{25 + 9}$$

$$r = \sqrt{34}$$

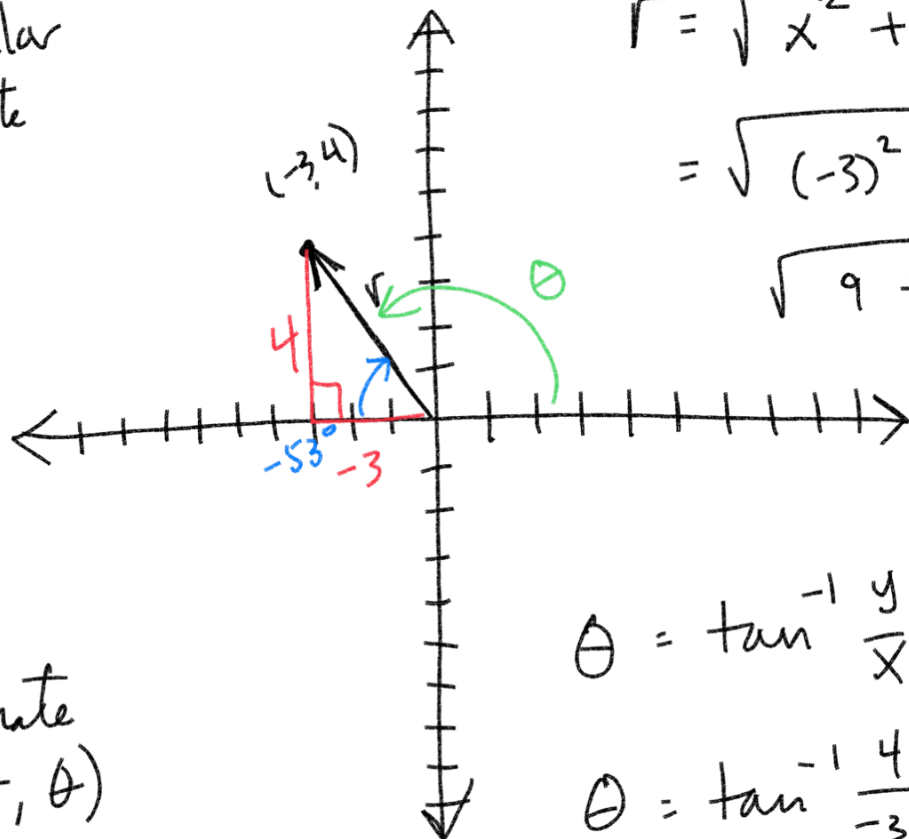
(r, θ)

$$\boxed{(\sqrt{34}, 31^\circ)}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

$$\theta = \tan^{-1}\left(\frac{3}{5}\right) \approx 31^\circ$$

Rectangular
Coordinate
 $(-3, 4)$



$$r = \sqrt{x^2 + y^2}$$
$$= \sqrt{(-3)^2 + (4)^2}$$
$$= \sqrt{9 + 16}$$

$$\sqrt{25} = 5$$
$$r = 5$$

Polar
Coordinate
 (r, θ)

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

$$\theta = \tan^{-1} \frac{4}{-3} = -53.1^\circ$$

$$180 - 53 = \boxed{127^\circ}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\text{opp}}{\text{adj}}$$

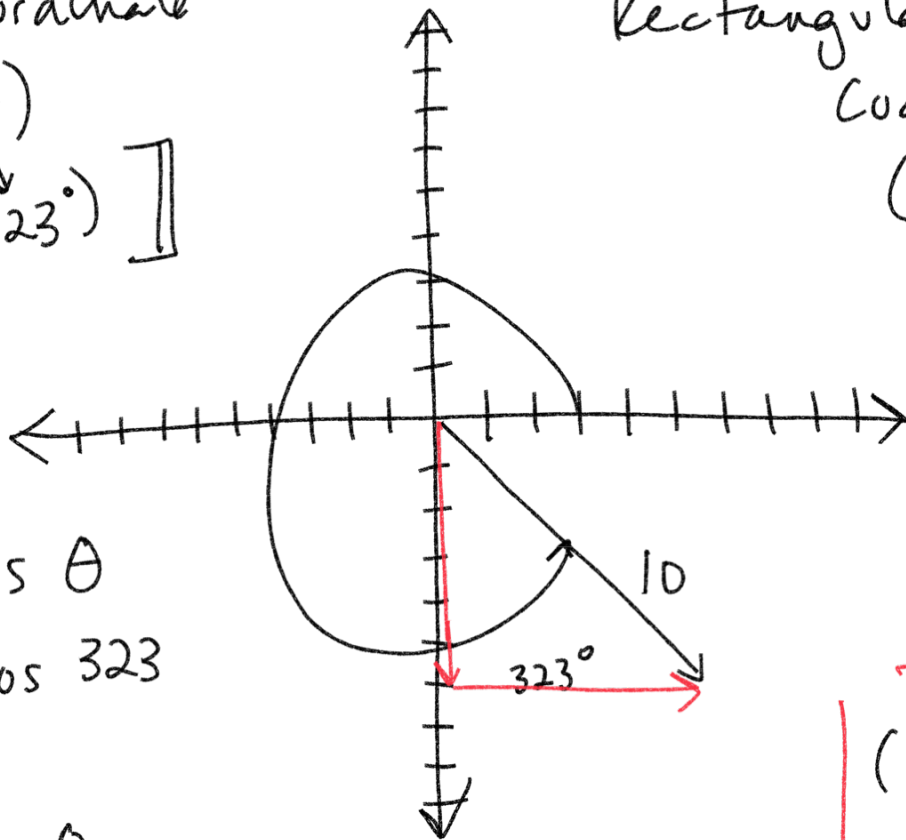
$$\cot \theta = \frac{\text{adj}}{\text{opp}}$$

$$\boxed{(5, 127^\circ)}$$

Polar coordinate

$$\begin{array}{c} (r, \theta) \\ \downarrow \quad \downarrow \\ (10, 323^\circ) \end{array}$$

Rectangular
Coordinates
 (x, y)



$$\begin{aligned} x &= r \cos \theta \\ &= 10 \cos 323 \\ &= 8 \end{aligned}$$

$$\begin{aligned} y &= r \sin \theta \\ &\downarrow \\ &10 \sin 323 \\ &= -6 \end{aligned}$$

$$(8, -6)$$