

Trig 9.4

Write the polar form of a linear equation
Graph the polar form of a linear equation
Write the linear form of a polar equation

$$y = mx + B$$

linear

lin \rightarrow polar

polar

polar \rightarrow linear

radians / degrees

normal

\perp

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

cos (A-B) from parking lot...

whiteboards (?)

p =length of normal (perpendicular), ϕ =reference angle, θ = variable

**Polar Form
of a Linear
Equation**

The polar form of a linear equation, where p is the length of the normal and ϕ is the positive angle between the positive x -axis and the normal, is

$$p = r \cos (\theta - \phi).$$

← ϕ

↑

$$\text{distance} = r \cos (\theta - \text{ref } \angle)$$

ϕ

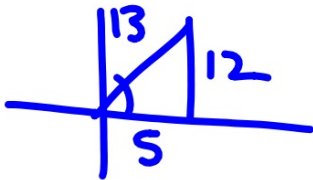
Also graph

1 Write each equation in polar form.

a. $5x + 12y = 26$

$$\frac{5x}{13} + \frac{12y}{13} - \frac{26}{13} = 0$$

$$\frac{5}{13}x + \frac{12}{13}y - 2 = 0$$



$$2 = r \cos(\theta - 67)$$

$$\tan^{-1} \frac{12}{5}$$

$$\theta = 67$$

1 gen form
2

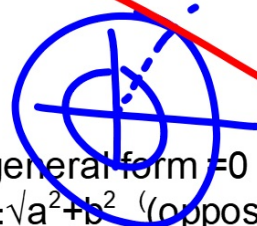
The normal form is $x \cos \phi + y \sin \phi - p = 0$.

$$2 = r \cos(\theta - 67)$$

phi "fee"

$$5^2 + 12^2 = \sqrt{169}$$


$$\theta = 37$$



- ✓ 1. general form $\neq 0$
- ✓ 2. $\pm \sqrt{a^2 + b^2}$ (opposite of C)
- 4. divide for cos & sin
- 5. use \tan^{-1} for ref angle

b. $2x - 7y = -5$

$$\frac{2x}{-\sqrt{53}} - \frac{7y}{-\sqrt{53}} + \frac{5}{-\sqrt{53}} = 0$$

$$-\frac{2x}{\sqrt{53}} + \frac{7y}{\sqrt{53}} - \frac{5}{\sqrt{53}} = 0$$


$$4 + 49 = c^2$$

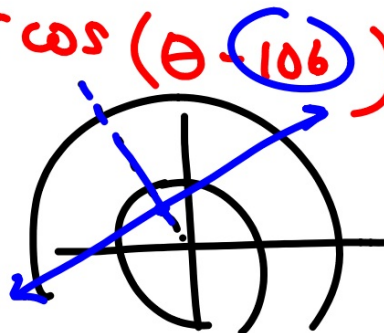
$$53 = c^2$$

$$\sqrt{53}$$

1. general form
2. $\pm\sqrt{a^2+b^2}$ (opposite of C)
4. divide for cos & sin
5. use \tan^{-1} for ref angle

$$\frac{5\sqrt{53}}{53} = r \cos(\theta - 106)$$

0.7



graph

Write each equation in polar form. Round ϕ to the nearest degree.

5. $\frac{3x}{5} - \frac{4y}{5} - \frac{10}{5} = 0$

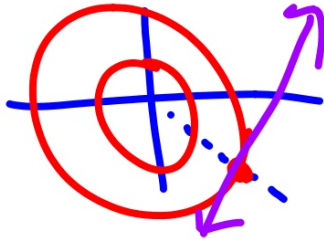
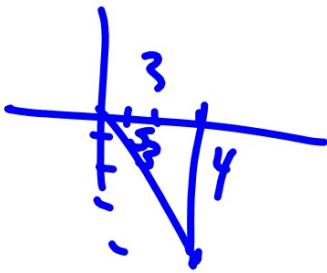
6. $-2x + 4y = 9$

$\frac{3}{5}x - \frac{4}{5}y - 2 = 0$

$2 = r \cos(\theta - 307)$

1. general form
2. pyth theor
3. divide for p (opp)
4. tan for angle (ref triangle)

How to graph?

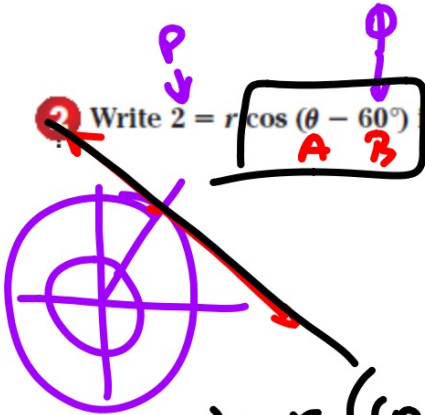


cos(A-B)
ans in gen form

Q Write $2 = r \cos(\theta - 60^\circ)$ in rectangular form.

$$Ax + By = C$$

$$y = mx + B$$



$$2 = r (\cos \theta \cos 60 + \sin \theta \sin 60)$$

$$2 = r \left(\frac{1}{2} \cos \theta + \frac{\sqrt{3}}{2} \sin \theta \right)$$

$$2 = \frac{1}{2} r \cos \theta + \frac{\sqrt{3}}{2} r \sin \theta$$

$$2 \left(2 = \frac{1}{2} x + \frac{\sqrt{3}}{2} y \right)$$

$$4 = x + \sqrt{3} y$$

$$\rightarrow x + \sqrt{3} y - 4 = 0$$

Write each equation in rectangular form.

$$7.3 = r \cos(\theta - 60^\circ)$$

$$r = 2 \sec\left(\theta + \frac{\pi}{4}\right)$$

**re-write to cos

$$3 = r (\cos \theta \cos 60 + \sin \theta \sin 60)$$

$$r = \frac{2}{\cos\left(\theta + \frac{\pi}{4}\right)}$$

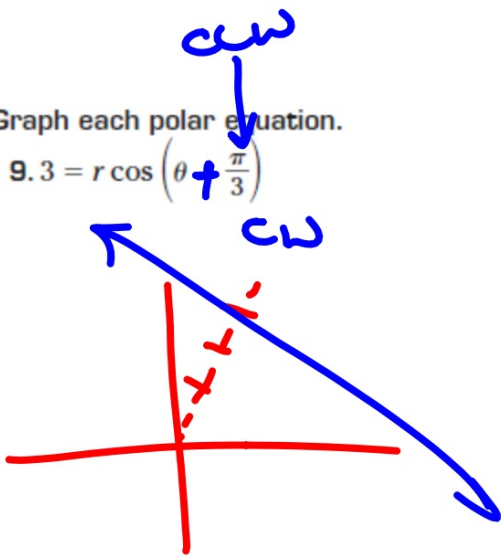
$$3 = r \left(\frac{1}{2} \cos \theta + \frac{\sqrt{3}}{2} \sin \theta \right)$$

$$2 = r \cos\left(\theta + \frac{\pi}{4}\right)$$

$$\begin{aligned} 3 &= \frac{1}{2}x + \frac{\sqrt{3}}{2}y \\ 6 &= x + \sqrt{3}y \end{aligned} \quad x + \sqrt{3}y - 6 = 0$$

Graph each polar equation.

$$9.3 = r \cos\left(\theta + \frac{\pi}{3}\right)$$



\ominus opposite

10. $r = 2 \sec(\theta + 45^\circ)$

change to cos

$$r = \frac{2}{\cos(\theta + 45^\circ)}$$
$$2 = r \cos(\theta + 45^\circ)$$

9.4
13-33002