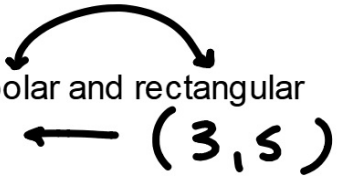
Trig 9.3

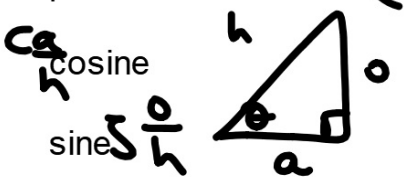
Convert between polar and rectangular coordinates



rectangular coordinates

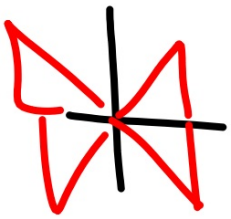
polar coordinates

cosine



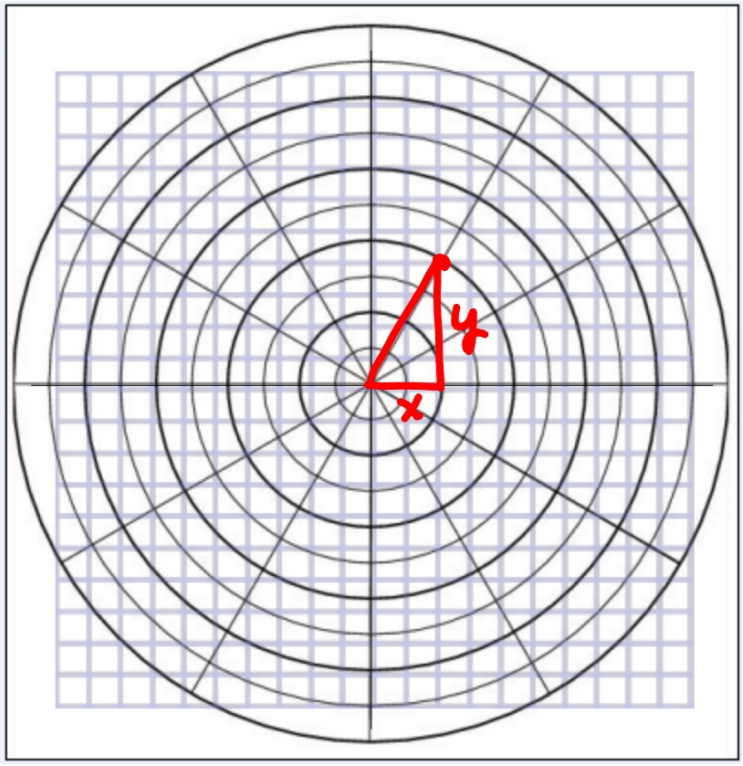
sine

hypotenuse



tangent, inverse tangent

whiteboards



<<
<

x, y

(2, 4)

(4, 60°)

r, θ

Right triangle:

cos=

sin=

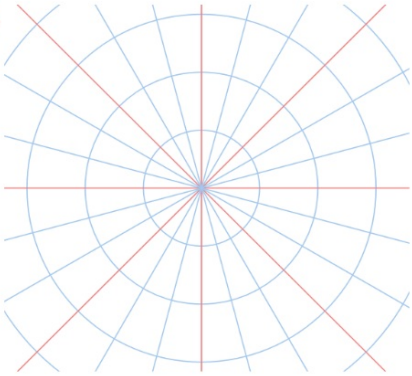
$x = r\cos\theta$

$y = r\sin\theta$

In a polar coord. system:

$x = r\cos\theta$

$y = r\sin\theta$



Converting Polar Coordinates to Rectangular Coordinates

The rectangular coordinates (x, y) of a point named by the polar coordinates (r, θ) can be found by using the following formulas.

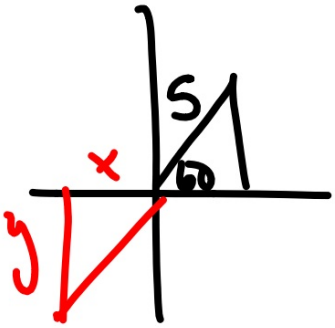
$$x = r\cos\theta$$
$$y = r\sin\theta$$

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

Use exact answers when handy angles

1 Find the rectangular coordinates of each point.

a. $P\left(5, \frac{\pi}{3}\right)$ → $(5, 60°)$

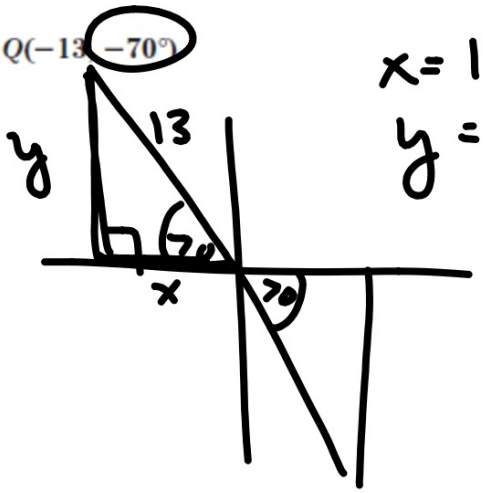


$x = 5\cos 60 = 5 \cdot \frac{1}{2} = 2.5 = \frac{5}{2}$

$y = 5\sin 60 = \frac{5\sqrt{3}}{2}$

decimal answers when not handy angles

b. $Q(-13, -70°)$



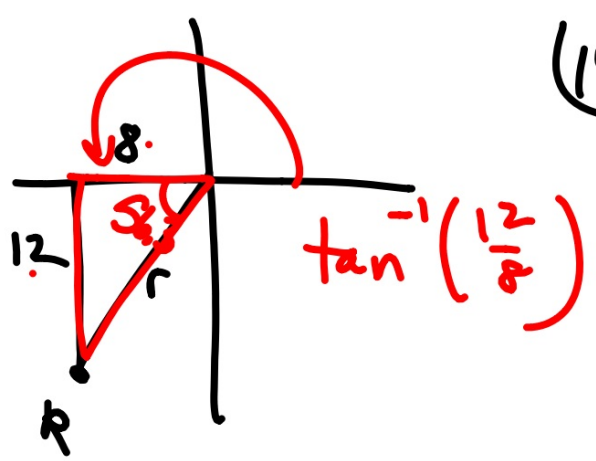
$x = 13\cos 70 = 4.45$

$y = 13\sin 70 = 12.22$

$(-4.45, 12.22)$

Use reference angles if not in Q1 sketch first...

3 Find the polar coordinates of $R(-8, -12)$.

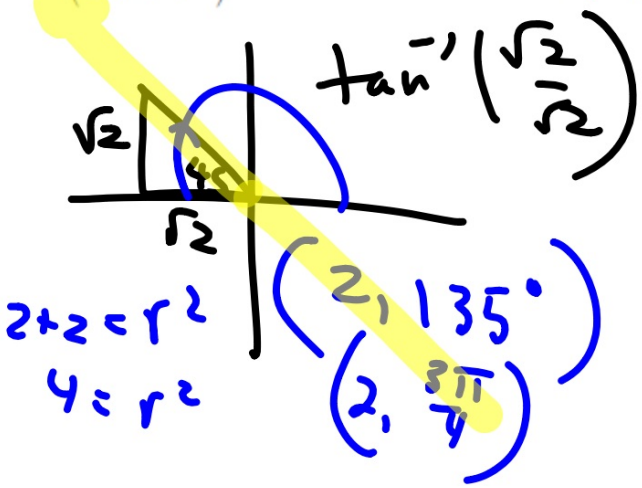


$(14.4, 236.3°)$

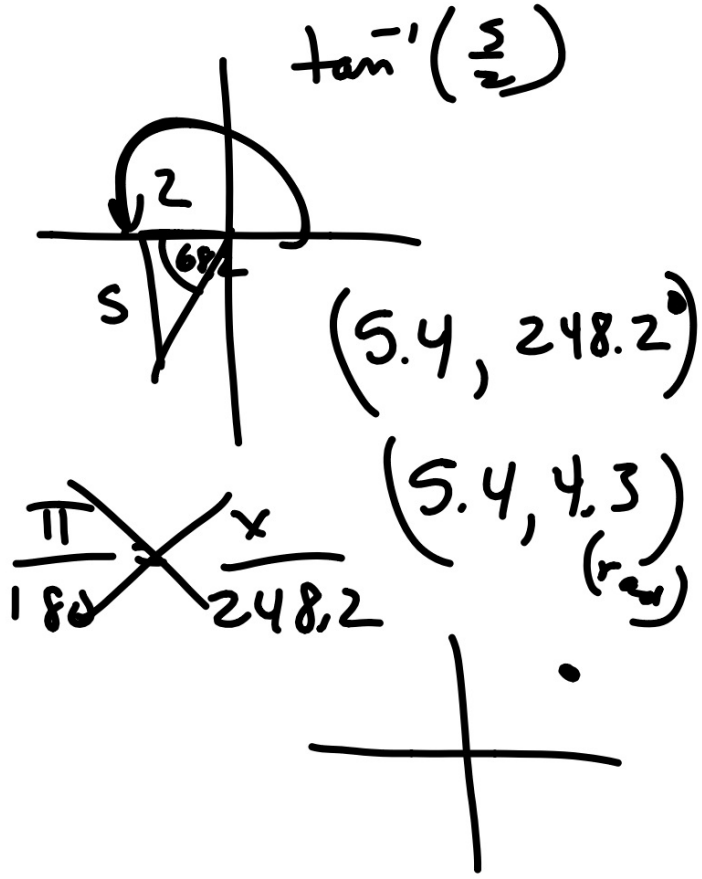
exact answers when handy angles

Find the polar coordinates of each point with the given rectangular coordinates.
Use $0 \le \theta < 2\pi$ and $r \ge 0$.

5. $(-\sqrt{2}, \sqrt{2})$



6. $(-2, -5)$



Tiny little parking lot...

$y=r\sin\theta$

$x=r\cos\theta$

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

rectangular: x's y's polar: r's sin cos

Examples **4** Write the polar equation $r = 6\cos\theta$ in rectangular form.

$r = 6\cos\theta$

$r \cdot r = 6\cos\theta \cdot r$

Goal: r, sin, cos ....out
x, y ...in

polar | rect

r | x

cos | y

sin

θ

$r^2 = 6r\cos\theta$

$x^2 + y^2 = 6x$

$x^2 - 6x + y^2 = 0$

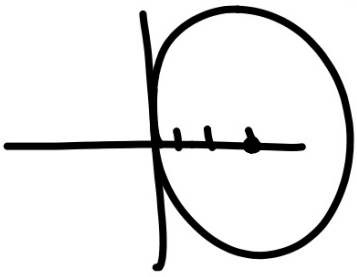
$(x^2 - 6x + 9) + y^2 = 0 + 9$

$(x-3)^2 + y^2 = 9$

9

-3 -3

-6



Write each polar equation in rectangular form.

11. $r = 6$

12. $r = -\sec\theta$

$r = \frac{-1}{\cos\theta}$

sec = 1/cos

$r^2 = 6r$

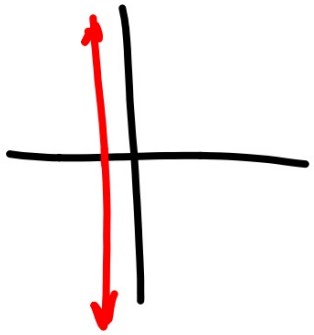
$r^2 = 36$

$x^2 + y^2 = 36$

$\frac{r}{1} = \frac{-1}{\cos\theta}$

$-1 = r\cos\theta$

$-1 = x$



EWE

5 Write the rectangular equation $(x-3)^2+y^2=9$ in polar form.

$x^2-6x+9+y^2=9$
$\quad -9 \qquad -9$

$r^2-6r\cos\theta=0$ $\quad x^2+y^2=6x$

$r(r-6\cos\theta)=0$ $\quad r^2-6r\cos\theta=0$

$r=0 \quad r-6\cos\theta=0$

15-39o

51, 53, 55

Write each rectangular equation in polar form.

9. $y = 2$

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