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

$x^2+y^2=r^2$ Polar (r,θ)

Converting Equations (Polar/Rectangular)

Convert the following equation from its rectangular form to its polar form:

circle

$x^2 + y^2 = 25$ centered at $(0,0)$, $r=5$

$r^2 = 25$

$r = 5$

Polar form

Circle centered at pole, $r=5$

1. get rid of x, y
2. $r=1$.

1. solve for r
2. divide r

Convert the following equation from its rectangular form to its polar form:

$(x-2)^2 + y^2 = 4$ Circle $r=2$, centered at $(2,0)$

$x^2-4x+4+y^2=4$

$x^2+y^2-4x+4=4$

$r^2-4x+4=4$

$r^2-4x=0$

$r^2-4(r\cos\theta)=0$

$\frac{r^2}{r}-\frac{4r\cos\theta}{r}=\frac{0}{r}$

$r-4\cos\theta=0$

$r=4\cos\theta$

Convert the following equation from its rectangular form to its polar form:

x = 5

Line Vertical

$$\frac{r\cdot\cos\theta}{\cos\theta} = \frac{5}{\cos\theta}$$

$$r = \frac{5}{\cos\theta}$$

Convert the following equation from its rectangular form to its polar form:

y = -3

Horizontal Line

$$\frac{r\cdot\sin\theta}{\sin\theta} = \frac{-3}{\sin\theta}$$

$$r = \frac{-3}{\sin\theta}$$

Convert the following equation from its polar form to its rectangular form.

r = 5

r = polar

Circle, centered at pole, radius 5.

$r^2 = 5^2$

$r^2 = 25$

$x^2+y^2 = 25$

1. Square both sides
2. multiply by r

$r\cdot r = 5r$

$r^2 = 5r$

$x^2+y^2 = 5r$

$x^2+y^2 = 5\cdot 5$

$x^2+y^2 = 25$

, r=5 (1)

Polar

Convert the following equation from its polar form to its rectangular form (hint: complete the square is needed)

$r = 8\cos\theta$ ← Circle

$r^2 = 8 \cdot r \cdot \cos\theta$

$x^2 + y^2 = 8x$

$x^2 - 8x + 16 + y^2 = 16$

$(x-4)^2 + y^2 = 16$ ← Circle Centered at $(4,0)$ $r = 4$

circle

Convert the following equation from its polar form to its rectangular form (hint: complete the square is needed)

$r = 3\sin(\theta)$

$r^2 = 3 \cdot r\sin\theta$

$x^2 + y^2 = 3y$

$x^2 + y^2 - 3y + \frac{9}{4} = \frac{9}{4}$

$x^2 + \left(y - \frac{3}{2}\right)^2 = \frac{9}{4}$

Converting Polar and Rectangular Equations: Practice

Write each rectangular equation in polar form.

1. $x^2 + y^2 = 36$

2. $x^2 + y^2 = 3y$

3. $x = -2$

4. $y = 6$

5. $x^2 + (y + 3)^2 = 25$

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

Write each polar equation in rectangular form.

7. $r = 4$

8. $r = 4\cos\theta$

9. $\boldsymbol{r = 5sin(\theta)}$

10. $\boldsymbol{r = 5cos(\theta)}$

WRITE THE OTHER FORM OF THE GIVEN EQUATION

1. $\boldsymbol{(x-3)^2+y^2=9}$

2. $x = 2$

3. $r = 4\cos(\theta)$

4. $x^2 + y^2 = 3$

5. $r = 2\sin(\theta)$

6. $y = -4$