

9 – 2 Polar Equations

Objective(s):

- Convert between polar and rectangular equations

Warm-up:

State three other pairs of polar coordinates for each point where $-2\pi < \theta < 2\pi$

$$\left(-1, -\frac{\pi}{6}\right)$$



$$\begin{aligned} & \left(1, \frac{5\pi}{6}\right) \\ & \left(1, -\frac{7\pi}{6}\right) \\ & \left(-1, \frac{11\pi}{6}\right) \end{aligned}$$

Concept: Formulas that link x , y , θ , and r .

$$x = r \cos \theta$$

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

$$y = r \sin \theta$$

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

Ex 1: Change $r = 6$ to a rectangular equation.

$$r^2 = 36$$

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

Ex 2: Change $r \cos \theta = 5$ to a rectangular equation.

$$x = 5$$

Ex 3: Change $x^2 + y^2 = 9$ to a polar equation.

$$r^2 = 9$$
$$r = \pm 3$$

Ex 4: Change $y = 3$ to a polar equation.

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

Ex 5: Change $r = 6 \cos \theta$ to a rectangular equation.

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

or

$$x^2 - 6x + 9 + y^2 = 9$$
$$(x - 3)^2 + y^2 = 9$$

Ex 6: Change $x^2 + y^2 = 4x$ to a polar equation.

$$r^2 = 4r \cos \theta$$
$$r = 4 \cos \theta$$

Ex 7: Change $r = 7 \sec \theta$ to a rectangular equation.

$$\cos \theta \cdot r = \frac{7}{\cos \theta} \cdot \cos \theta$$

$$r \cos \theta = 7$$
$$x = 7$$

Ex 8: Change $r = 8 \sin \theta$ to a rectangular equation.

$$r^2 = 8r \sin \theta$$
$$x^2 + y^2 = 8y$$

or

$$x^2 + y^2 - 8y + 16 = 16$$
$$x^2 + (y - 4)^2 = 16$$