Warm Up 4/9

$\frac{2\pi}{3} = \left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ (cos, sin)

Convert the following polar coordinates into rectangular coordinates.

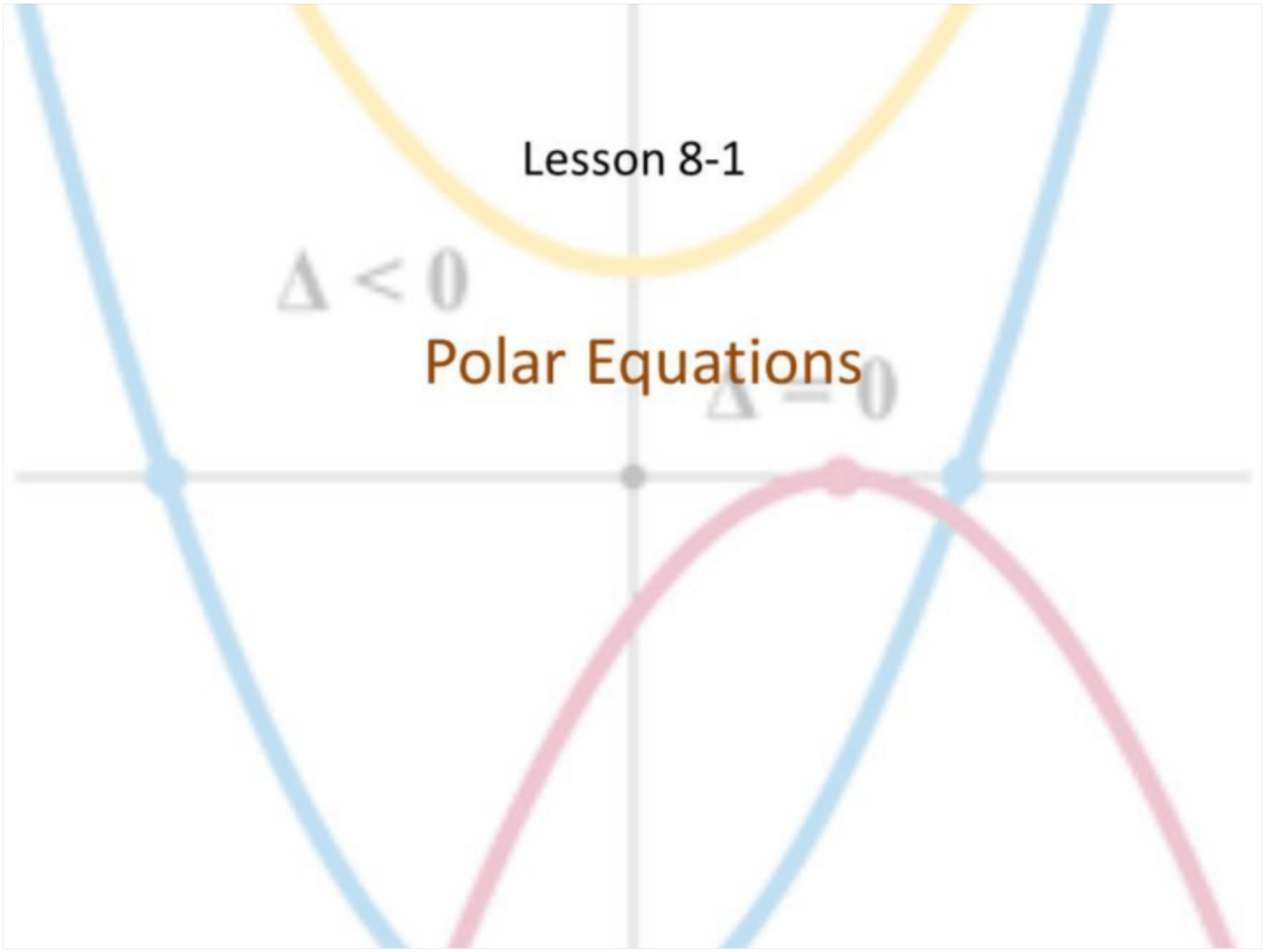
1. $\left(6, \frac{2\pi}{3}\right) \rightarrow (x, y) = (r\cos\theta, r\sin\theta)$.

$= \left(6\cos\frac{2\pi}{3}, 6\sin\frac{2\pi}{3}\right) = \left(6\left(-\frac{1}{2}\right), 6\left(\frac{\sqrt{3}}{2}\right)\right) = (-3, 3\sqrt{3})$

2. $(0, 13\pi)$

$= (0, 0)$

$(0, 0)$


Lesson 8-1
$\Delta < 0$
Polar Equations
$\Delta = 0$

Objective

Students will…

- Be able to convert rectangular equations into polar equations.

Recap

So, for recap...

Relationship between Polar and Rectangular Coordinates

1. To change from polar to rectangular coordinates, use the formulas

$$x = r\cos\theta \quad \text{and} \quad y = r\sin\theta$$

2. To change from rectangular to polar coordinates, use the formulas

$$r^2 = x^2 + y^2 \qquad \text{and} \qquad \tan\theta = \frac{y}{x} \quad (x \neq 0)$$

Polar Equations

$2x = x - 4$
$-x \quad -x$

$r = \ldots$

Polar Equations are equations solved for r, written in terms of $\sin\theta$, $\cos\theta$, or a combination of both.

Since $x = r\cos\theta$ and $y = r\sin\theta$, all rectangular equations (written in terms of x and y) can be written in polar equation form. We use the following steps.

Ex. Write the equation $y = 2x - 9$ in polar form.

Rewrite x as $r\cos\theta$ and y as $r\sin\theta$: $r\sin\theta = 2(r\cos\theta) - 9$

$+9$

$r - \sin\theta + 2\cos\theta$

Simplify and solve for r: $r\sin\theta = 2r\cos\theta - 9$

$-2r\cos\theta \quad -2r\cos\theta$

$r\sin\theta - 2r\cos\theta = -9$

$r(\sin\theta - 2\cos\theta) = -9$

$(\sin\theta - 2\cos\theta) \qquad (\sin\theta - 2\cos\theta)$

Examples

Express the equation $x^2 = 4y$ in polar form.

$\Rightarrow (r\cos\theta)^2 = 4(r\sin\theta)$

$\Rightarrow \frac{r^2\cos^2\theta}{r} = \frac{4r\sin\theta}{r}$.

$\frac{r\cos^2\theta}{\cos^2\theta} = \frac{4\sin\theta}{\cos^2\theta} = \frac{4\sin\theta}{1-\sin^2\theta}$

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

Example

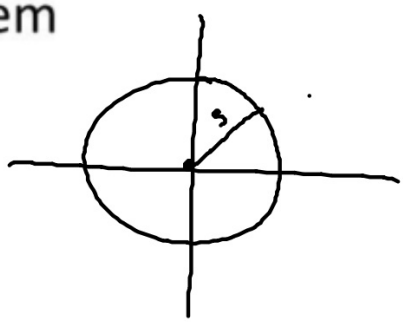
Convert the equation $x = 1$ to polar form.

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

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

Homework Problem

Convert the equation to polar form.



42. $x^2 + y^2 = 9$

$\Rightarrow (r\cos\theta)^2 + (r\sin\theta)^2 = 9$

$= r^2\cos^2\theta + r^2\sin^2\theta = 9$

$= r^2(\cos^2\theta + \sin^2\theta) = 9$

$\sqrt{r^2} = \sqrt{9}$

$r = \pm 3$

Homework 4/9

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