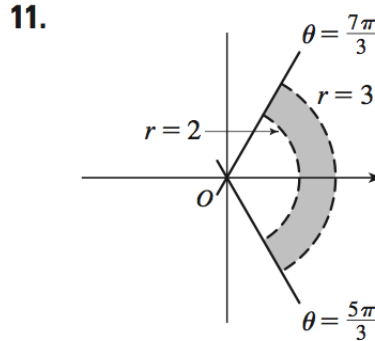
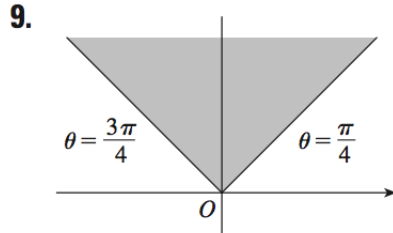


Lecture 20

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1. Sketch the region $r \geq 0$, $\pi/4 \leq \theta \leq 3\pi/4$. Sketch the region $2 < r < 3$, $5\pi/3 \leq \theta \leq 7\pi/3$.



2. Identify the curve by finding a Cartesian equation for the curve $r = 2 \cos \theta$.

Recall $x = r \cos \theta$ and $y = r \sin \theta$, so

$$x = 2 \cos^2 \theta = 1 + \cos(2\theta)$$

$$y = 2 \cos \theta \sin \theta = \sin 2\theta$$

so this is a circle centered around $(1, 0)$ with radius 1. It has equation $(x - 1)^2 + y^2 = 1$.

3. Identify the curve by finding a Cartesian equation for the curve $r^2 \cos 2\theta = 1$.

Note that $r^2 = x^2 + y^2$ and $\cos 2\theta = 2 \cos^2 \theta - 1 = 2(\frac{x}{r})^2 - 1$. Therefore

$$1 = r^2 \cos 2\theta = r^2(2(\frac{x}{r})^2 - 1) = 2x^2 - r^2 = 2x^2 - (x^2 + y^2) = x^2 - y^2$$

which is a hyperbola, centered around $(0, 0)$, with foci on x -axis.

4. Sketch the curve with the given polar equation by first sketching the graph of r as a function of θ in Cartesian coordinates.

$$r = 2(1 + \cos \theta)$$

$$r = 4 \sin 3\theta$$

$$r = 1 + 2 \cos 2\theta$$

