Unit 2 Study Guide

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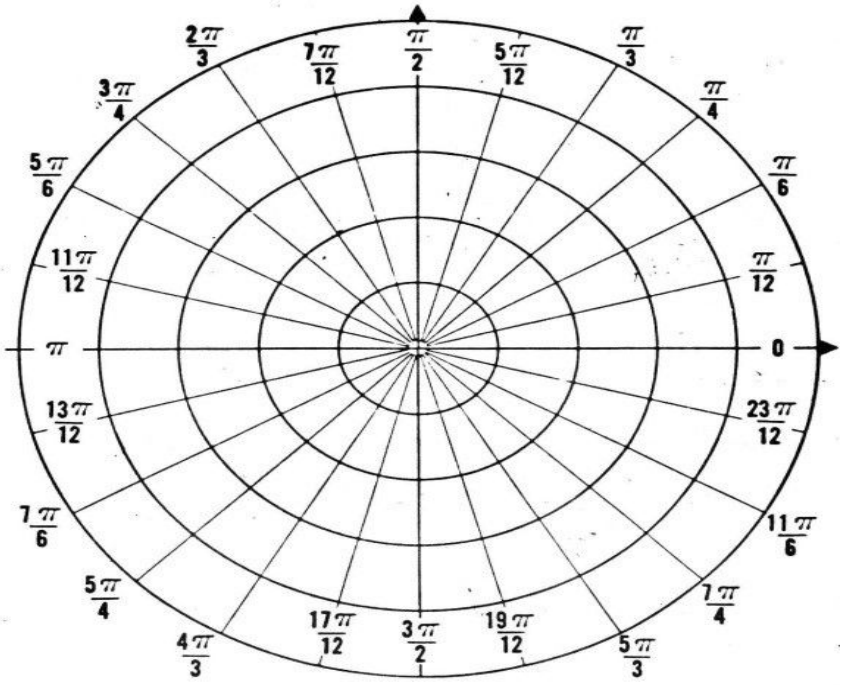
Important Vocabulary

- **Pole**: the origin
- **Polar axis**: ray extending to the right of the pole
- **r**: the radius
- **θ**: theta, the angle measurement
- **Polar coordinate system**: Points are ordered by (r , θ)
- **Limacon curves**: x-axis symmetry is cosine, y-axis symmetry is sine, if addition it is on the positive axis, if negative it is on the negative axis
- **Sector**: part of a circle used to calculate area
- **dr/dθ**: the change in r with respect to theta

Important Concepts

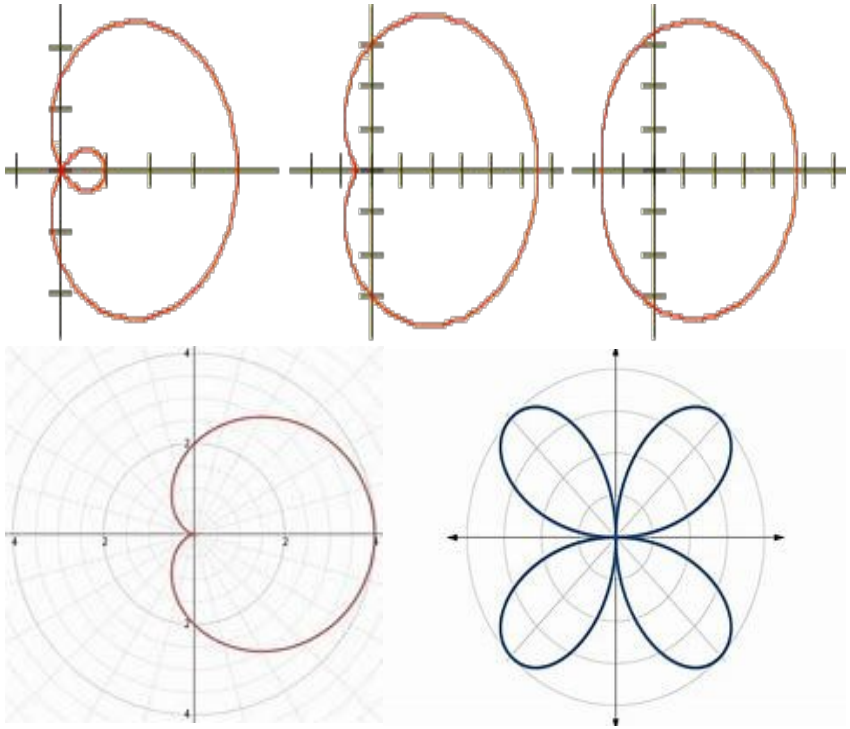
Plotting Polar Points: Plot the points in the order of (r, θ) by finding the line the angle correlates with, and moving up or down the circles correlating to the radius



Important Concepts

Types of Polar Graphs:

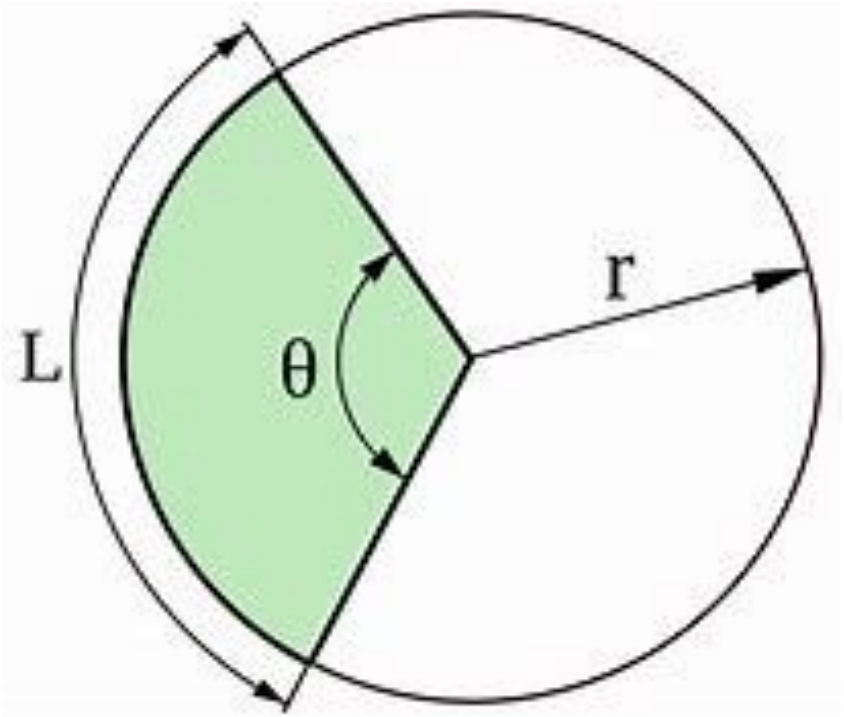
- **Limacon**: r = a + b sinθ , r = a - b sinθ , r = a + b cosθ , r = a - b cosθ
- **Rose Curve**: r = asin(bθ) r = acos(bθ) If “b” is even, then there is double the amount of petals. If “b” is odd, then it is that exact amount of petals. “A” is the length of each petal
- **Cardioid**: (a/b) = 1
- **Inner Loop**: (a/b) < 1
- **Dimpled**: 1 < (a/b) < 2
- **Convex**: 2 < (a/b)



Important Concepts

Arc Length:

$$L = \int_{\alpha}^{\beta} \sqrt{(r^2 + (dr/d\theta)^2)}\, d\theta$$

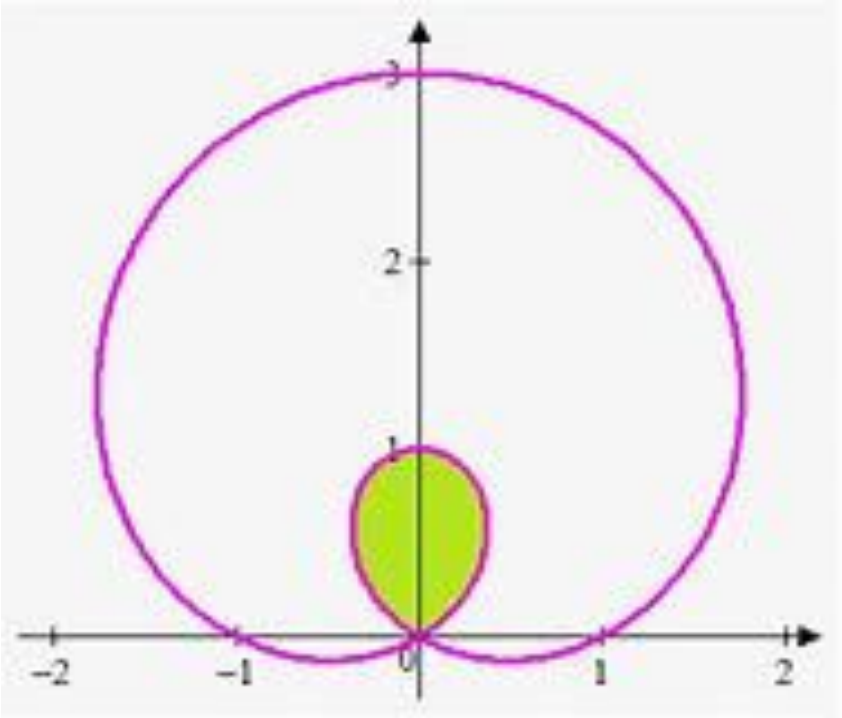


Important Concepts

Area Enclosed by a Polar Curve:

$$A = \frac{1}{2} \int r^2 d\theta$$

$$A_{sector} = \frac{1}{2} r^2 \theta$$

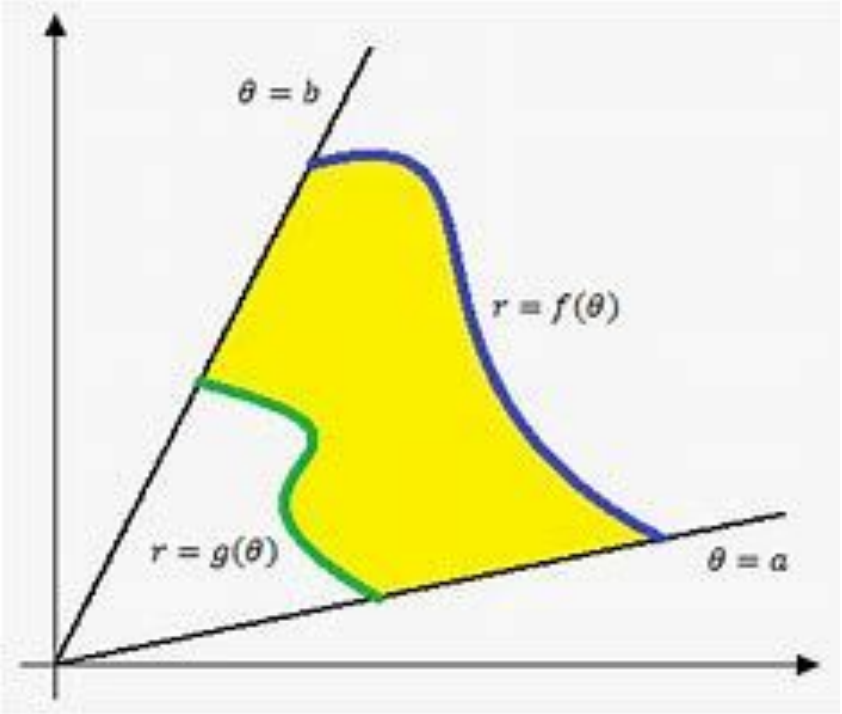


Important Concepts

Area between Polar Curves: To find the area between two polar curves, use the equation

$$\frac{1}{2}\int_{\alpha}^{\beta} R^2 - r^2 d\theta$$

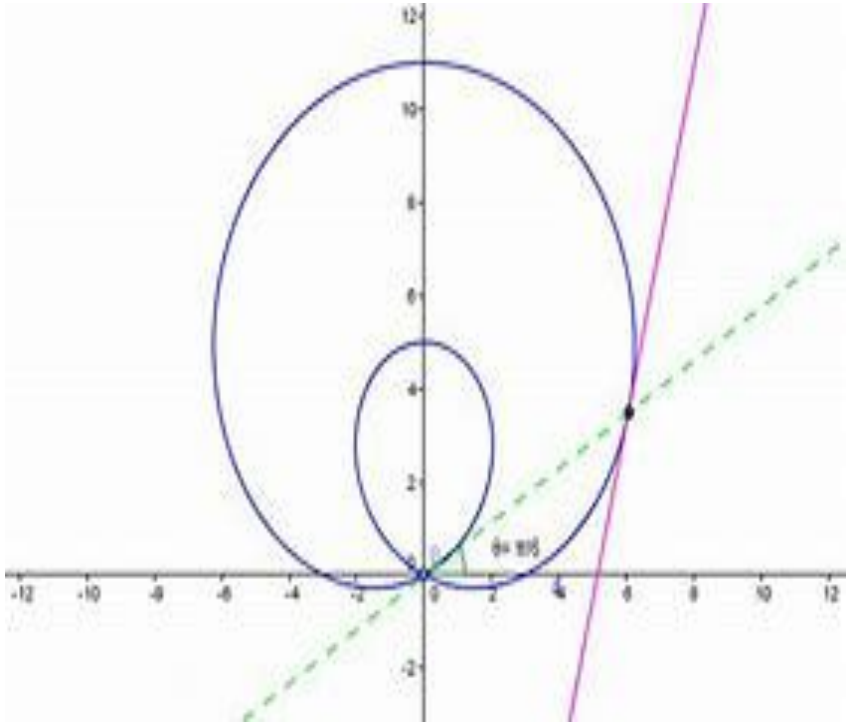
Where R is the equation of the curve farthest from the origin, and r is the equation of the curve closest to the origin. Your bounds will be the angle measurements of the ends of the curves



Important Concepts

Slopes and Tangents of Polar Curves:

$$\frac{\frac{dr}{d\theta}\sin\theta + r\cos\theta}{\frac{dr}{d\theta}\cos\theta - r\sin\theta}$$



Important Concepts

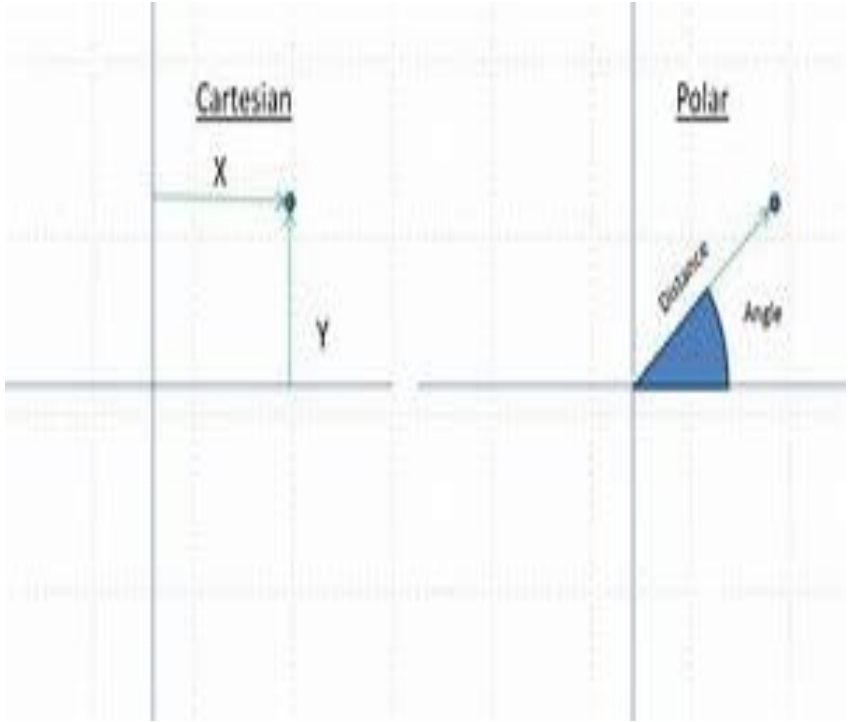
Converting between Polar and Cartesian:

$Y = r\sin\theta$

$X = r\cos\theta$

$\theta = \tan^{-1}(y/x)$

$r = \sqrt{(x^2 + y^2)}$



Example Problems

1. Plot the point $(2 , -7\pi/6)$
2. Sketch the polar graph of $r = 5\sin\theta$ and write the domain
3. Find where the graphs $r=\cos\theta$ and $r= 1-\cos\theta$ intersect
4. Convert from polar to cartesian: $r + 4\cos\theta = 2\sin\theta$

Example Problem

5. Find the area inside the inner loop of $r= 3-8\cos\theta$

6. Find the area that is inside $r=4-2\cos\theta$ and outside $r=6+2\cos\theta$

7. Find the arc length of $r=-4\sin\theta$, $0 \leq \theta \leq \pi$

8. Determine the equation of the tangent line to $r=3+8\sin\theta$ at $\theta= \pi/6$