W14 - Homework

Stepwise problems - Thu. 11:59pm

Polar curves

01

Convert points: Cartesian to Polar

Convert the Cartesian (rectangular) coordinates for these points into polar coordinates:

(a) $(1, 0)$ (b) $(3, \sqrt{3})$ (c) $(-2, 2)$ (d) $(-1, \sqrt{3})$

02

Convert equations: Polar to Cartesian

Convert the polar equation to a Cartesian equation. Be sure to simplify.

(a) $r = 7$ (b) $r = 2\sin\theta$ (c) $r = \dfrac{1}{\cos\theta - \sin\theta}$

Calculus with polar curves

03

Polar curve - Vertical or horizontal tangent lines

Find all points on the given curve where the tangent line is horizontal or vertical.

$$r = \cos\theta \qquad \theta \in [0, 2\pi)$$

Hint: First determine parametric Cartesian coordinate functions using θ as the parameter.

04

Arclength of one loop of a rose

Consider the graph of the polar curve $r = 2\cos 3\theta$.

Set up an integral which computes the arclength of one loop of this curve.

Regular problems - Sat. 11:59pm

Polar curves

05

Convert points: Polar to Cartesian

Convert the polar coordinates for these points into Cartesian (rectangular) coordinates:

(a) $\left(3, \frac{\pi}{6}\right)$ (b) $\left(-6, \frac{3\pi}{4}\right)$ (c) $\left(0, \frac{\pi}{5}\right)$ (d) $\left(5, -\frac{\pi}{2}\right)$

06

Convert equations: Cartesian to Polar

Convert the Cartesian equation to a polar equation. Be sure to simplify.

(a) $x^2 + y^2 = 25$ (b) $x = 5$ (c) $y = x^2$

07

Sketching limaçons

Sketch the graphs of the following polar functions:

(a) $r = 2 + \sin\theta$ (b) $r = 2\cos\theta$

(c) $r = 1 + 2\sin\theta$ (d) $r = 3 + 3\cos\theta$

08

Sketching roses

Sketch the graphs of the following polar functions.
Use numbers to label the *order* in which the leaves/loops are traversed.

(a) $r = \sin 2\theta$ (b) $r = \sin 3\theta$ (c) $r = 2\cos 2\theta$

Calculus with polar curves

09

Polar curve - Slope of tangent line

Find the slope of the tangent line to the given polar curve:

$$r = \sin\theta + 3\cos\theta \qquad \text{at } \theta = \pi/2$$

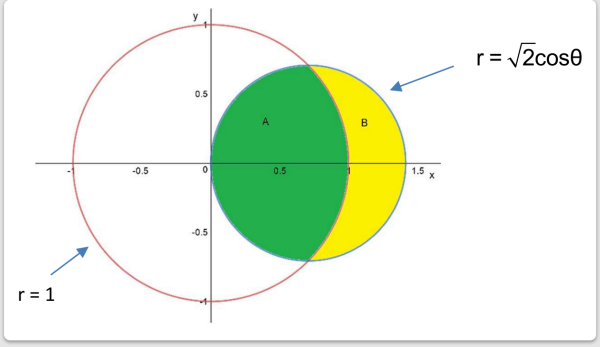
Hint: First determine parametric Cartesian coordinate functions using θ as the parameter.

10

Polar coordinates - lunar areas

(a) Find the area of the green region.

(b) Find the area of the yellow region.

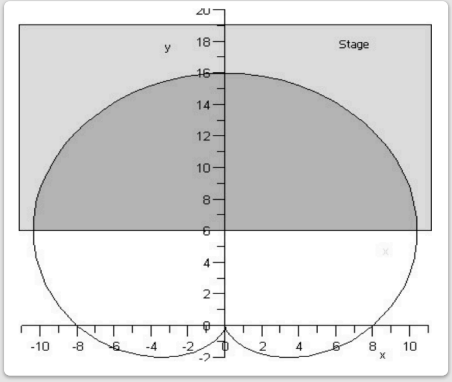


11

Pickup region of a microphone - limaçon area

The pickup region of a microphone is described by a limaçon with equation $r = 8 + 8\sin\theta$, and part of the region is on a stage.

Find the area of the part of the region on the stage.



12

Area of an inner loop

A limaçon is given as the graph of the polar curve $r = 1 + 2\sin\theta$.

Find the area of the inner loop of this limaçon.