

10.2/10.3: Parametric Curves and Polar Coordinates

Friday, January 22

Warmup

1. $\sin(\pi/2) =$

4. $\sin(5\pi/3) =$

7. $\frac{d}{dx} \sin(\cos^2(x))$

2. $\sin(5\pi/4) =$

5. $\sin(2\theta) =$

8. $\frac{d}{dx} x \cos x$

3. $\cos(5\pi/3) =$

6. $\cos(2\theta) =$

9. $\frac{d}{dx} \frac{x}{\sin x}$

1. Given (x, y) , what is (r, θ) ?

2. Given (r, θ) , what is (x, y) ?

3. Describe the path: $(x, y) = (-\sin(3t), \cos(3t)), 0 \leq t \leq \pi$

4. L'Hospital's rule says what?

Calculus with Parametric Curves

If $x = e^t, y = te^{-t}$, find dy/dx and d^2y/dx^2 , with and without eliminating the parameter. When is the curve concave upward?

If $x = 3t^2 + 1$ and $y = t^3 - 1$, at what points on the curve does the tangent line have slope $\frac{1}{2}$?

Find the slope of the tangent line to the trochoid $x = r\theta - d \sin \theta, y = r - d \cos \theta$ in terms of θ . (Here, the particle is distance d from the center of a circle of radius r , rolling on a flat surface.) Find all horizontal and vertical tangents.

Polar coordinates

Plot. Express in Cartesian coordinates and in at least two other ways in polar coordinates:

1. $(2, 3\pi/2)$
2. $(3, -\pi/3)$
3. $(1, 5\pi/6)$

Express in both Cartesian and polar coordinates:

1. A line through the origin that makes an angle of $\pi/6$ with the positive x -axis.
2. A vertical line through the point $(3, 3)$.

Find the slope of the tangent line to the given curve at the point specified:

1. $r = 2 \cos \theta, \theta = \pi/3$
2. $r = 1 + \sin 2\theta, \theta = \pi/4$
3. $r = 1/\theta, \theta = \pi$.