Warmup

1. \( \sin(\pi/2) = \)
2. \( \sin(5\pi/4) = \)
3. \( \cos(5\pi/3) = \)
4. \( \sin(5\pi/3) = \)
5. \( \sin(2\theta) = \)
6. \( \cos(2\theta) = \)
7. \( \frac{d}{dx} \sin(\cos^2(x)) \)
8. \( \frac{d}{dx} x \cos x \)
9. \( \frac{d}{dx} \sin x \)

1. Given \((x, y)\), what is \((r, \theta)\)?
2. Given \((r, \theta)\), 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 $x = rθ - d \sin θ, y = r - d \cos θ$ 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 $π/6$ 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. $r = 2 \cos θ, θ = \pi/3$
2. $r = 1 + \sin 2θ, θ = \pi/4$
3. $r = 1/θ, θ = π$. 