# Recitation 23: Parametric equations & Polar coordinates

## Warm up:

Describe the motion given by $x = 8$, $y = 7\sin(t)$ for all $t$.

## Group work:

**Problem 1** *Try to figure out the shape of the following curve and then eliminate the parameter and check your intuition.*

$$x = \ln t - 1 \qquad y = (\ln t)^2$$

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**Problem 2** *Find parametric equations for the path of a particle moving around the circle*

$$(x-3)^2 + (y+7)^2 = 4$$

(a) *one time around clockwise starting at* $(5, -7)$.

(b) *three times around counterclockwise starting at* $(5, -7)$.

(c) *halfway around clockwise starting at* $(1, -7)$.

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**Problem 3** *Find the intersection point(s) of the lines*

$$x = -6 + 9t, \qquad y = 3 - 2t \tag{1}$$

*and*

$$x = 3 + t, \qquad y = -4 - 2t. \tag{2}$$

*Do they intersect at the same time?*

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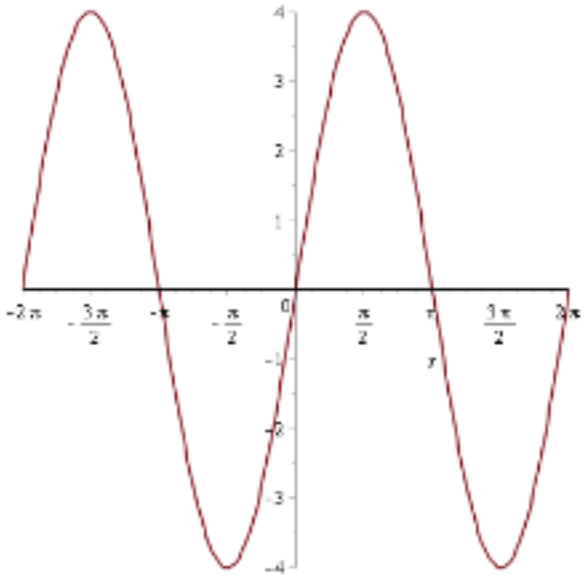
**Problem 4** *Consider the curve defined by the parameterization $x = t^2$, $y = t^3 - 3t$. Show that this curve has two tangent lines at $(3, 0)$, and find the equations of the tangent lines there.*

**Problem 5** *Plot the following (polar) points in the $xy$-plane and then rewrite them as rectangular coordinates.*

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

**Problem 6** *Rewrite the rectangular point $(3, 5)$ in polar coordinates in three different ways.*

**Problem 7** *The graph of the curve $r = 4\sin\theta$ is a circle. Use the graph below to sketch this circle. Can you verify this algebraically? What is the period of the polar curve? Is $0 \leq \theta \leq 2\pi$ necessary to complete the graph?*




**Problem 8** *Graph $r = 2 + 4\cos\theta$ using the "Cartesian-to-Polar" method.*