

## Homework 1

1. Sketch the parametric curve  $x = \sin(t)$ ,  $y = -t$ ,  $t = -\pi \dots \pi$ . Use arrows to indicate the direction of increasing  $t$ .
2. Find a parametric equation for a circle of radius 2, centered at  $(3, 4)$ .
3. (a) Sketch the region enclosed by the curve  $x = t^2$ ,  $y = \sin t$ ,  $0 \leq t \leq 1$ , the x-axis and the line  $x = 1$ . (b) Find the area of this region.
4. (a) Sketch the region enclosed by the curve  $x = t^2 - t$ ,  $y = \sqrt{t}$ , and the y-axis. (b) Find the area of this region.
5. Consider a parametric curve given by  $x = \sin t$ ,  $y = \cos^2 t$ ;  $t \in [0, \pi/2]$ .
  - (a) Sketch this curve.
  - (b) Determine the equation of the line tangent to this curve at  $t = \pi/2$ .
  - (c) Determine the area bounded by this curve and the x and y axes.
6. Sketch the following curves given in polar coordinates: (a)  $r = 1 - \cos \theta$ ,  $0 \leq \theta \leq 2\pi$ ; (b)  $r = 1 + \cos(\theta)$ ,  $0 \leq \theta \leq \pi$ ; (c)  $r = 1 + \cos(2\theta)$ ,  $0 \leq \theta \leq \pi$ .
7. Find the length of the curve  $x = e^{-t} \cos(2t)$ ,  $y = e^{-t} \sin(2t)$ ,  $t = 0..2$ .
8. Sketch the curve  $(x^2 + y^2)^3 = 4x^2y^2$  by first converting it to polar coordinates. Hint:  $2 \cos \theta \sin \theta = \sin(2\theta)$ .
9. A cow is tied to a silo with radius 1 by a rope just long enough to reach the opposite side of the silo. Find the area available for grazing by the cow.

