

## Math 203 — Polar coordinates

**Problem 1.** For each point given in Cartesian coordinates, find a polar coordinate representation. Likewise, for each point in polar coordinates, give its Cartesian coordinates.

Cartesian	Polar	Polar	Cartesian
$(1, -1)$		$(5, \pi)$	
$(-4, 0)$		$(2, 7\pi/4)$	
$(-\sqrt{2}/2, \sqrt{2}/2)$		$(1, -5\pi/4)$	
$(\sqrt{3}/2, 1/2)$		$(3, -5\pi/6)$	

**Problem 2.** Sketch the regions described by the following polar inequalities or equations.

- a.  $1 \leq r \leq 4$
- b.  $\pi/4 \leq \theta \leq 3\pi/4, r \geq 0$
- c.  $0 \leq r \leq 1, \pi/2 \leq \theta \leq 3\pi/2$
- d.  $1 \leq r \leq 2, 0 \leq \theta \leq 2\pi/3.$
- e.  $4 \leq r \leq 9, -3\pi/4 \leq \theta \leq 3\pi/4$

**Problem 3.** Sketch the following regions and express them using inequalities involving  $r$  and  $\theta$ . Assume all circles are centered at the origin.

- a. The region in the first quadrant enclosed by a quarter circle of radius 3.
- b. The region in the third and fourth quadrants enclosed by a half circle of radius 2.
- c. The region in the first and fourth quadrants enclosed by a half circle of radius 1.
- d. The annulus inside a circle of radius 5 and outside a circle of radius 2.
- e. The quarter annulus in the second quadrant inside a circle of radius 2 and outside a circle of radius 1.
- f. The quarter annulus in the top half of the  $xy$ -plane between the lines  $y = \pm x$  and inside the circle of radius 2 and outside the circle of radius 1.