

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

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

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

Problem 3. Sketch the following regions and express them using inequalities involving r and θ . 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.