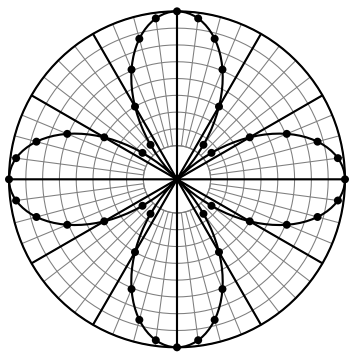
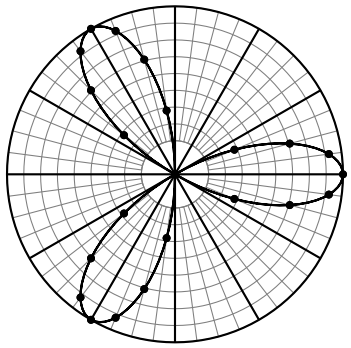
College of the Holy Cross
Math 135 (Calculus I)
Group Work 1: Polar Graphs
Due Monday, September 17

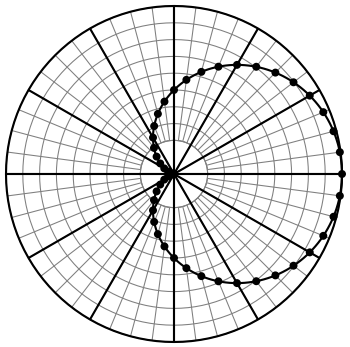
If f is a real-valued function defined on an interval $[a, b]$, the *polar graph* of f is the set of points with polar coordinates (r, θ) satisfying $r = f(\theta)$. For example:



$r = \cos(2\theta)$



$r = \cos(3\theta)$



$r = \frac{1}{2}(1 + \cos\theta)$

1. On a single piece of polar graph paper, plot the following:

(a) $r = 4\sin\theta$

(b) $r = 4\sin(2\theta)$

(c) $r = 4\sin(3\theta)$

2. On a single piece of polar graph paper, plot the following:

(a) $r = 1 + 3\cos\theta$

(b) $r = 2 + 2\cos\theta$

(c) $r = 3 + \cos\theta$

3. Convert each polar equation into a Cartesian equation, and identify the graph as a familiar curve.

(a) $r = 5$. Hint: Square, and use $r^2 = x^2 + y^2$.

(b) $r = 5\cos\theta$. Hint: Multiply both sides by r.

(c) $r = -4\sin\theta$.

(d) $r = \sec\theta$. Hint: Write secant in terms of cosine.

(e) $r = 3\csc\theta$.