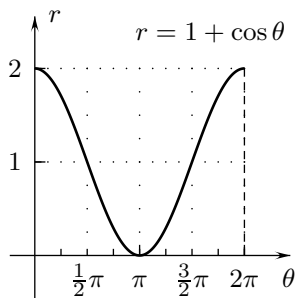


Math 10B. Lecture Examples.

Section 8.3. Area and arc length in polar coordinates[†]

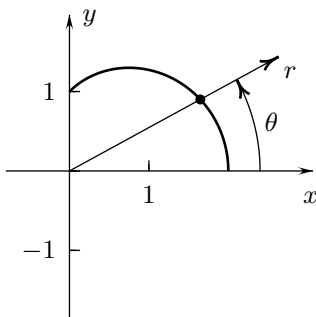
Example 1 Sketch the curve in an xy -plane with the polar equation $r = 1 + \cos \theta, 0 \leq \theta \leq 2\pi$. (The curve is called a *cardioid* because of its heart-like shape.)

Answer: Figures A1a, A1b, and A1c



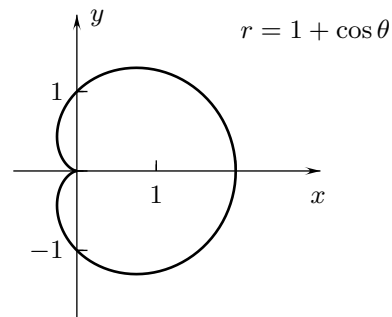
$r = 1 + \cos \theta$ in an $r\theta$ -plane

Figure A1a



The cardioid for $0 \leq t \leq \frac{1}{2}\pi$

Figure A1b



The entire cardioid

Figure A1c

Example 2 Find the area of the region bounded by the cardioid from Example 1 with polar equation $r = 1 + \cos \theta, 0 \leq \theta \leq 2\pi$. (Use the identity $\cos^2 \theta = \frac{1}{2}[1 + \cos(2\theta)]$ in the integration.)

Answer: [Area] = $\frac{3}{2}\pi$

Example 3 Use polar coordinates to find the area bounded by the circle $r = 4 \sin \theta, 0 \leq \theta \leq \pi$ in Figure 1.

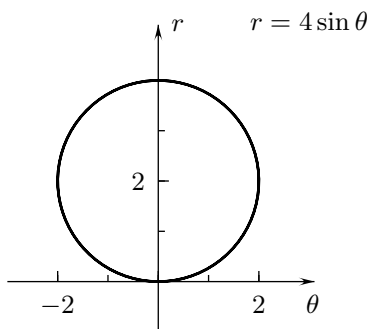


FIGURE 1

Interactive Examples

Work the following Interactive Examples on Shenk's web page, <http://www.math.ucsd.edu/~ashenk/>:[‡]

Section 11.3: Examples 1–5

[†]Lecture notes to accompany Section 8.3 of *Calculus* by Hughes-Hallett et al.

[‡]The chapter and section numbers on Shenk's web site refer to his calculus manuscript and not to the chapters and sections of the textbook for the course.