Math 231 ABCE. Spring 2012. Worksheet 22. April 30/May 1, 2012

These problems are for practice with polar curves.

1. A cardioid is defined in polar coordinates by the equation \( r = 1 + \sin \theta \). Make a careful sketch of \( r \) against \( \theta \) on the rectangular axes. Use this to make a careful sketch of the polar curve. Be sure that important angles are labelled clearly.

2. A limaçon is defined in polar coordinates by the equation \( r = 1 + 2 \sin \theta \). Make a careful sketch of \( r \) against \( \theta \) on the rectangular axes. Use this to make a careful sketch of the polar curve. Be sure that important angles are labelled clearly.
3. Make a sketch of \( r = \cos 3\theta \) and find the total area enclosed.

4. Find the area of the region enclosed by one loop of \( r = \sin 5\theta \).

Recall the formula for \( ds \) in polar coordinates:

\[
ds = \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2} \, d\theta
\]

and the basic fact that \( L = \int ds \).

5. Set up an integral for the total length of the curve \( r = \cos 3\theta \) from Problem 3.

6. Set up an integral for the total length of the curve \( r = \sin 5\theta \) from Problem 4.