MATH 164, Spring 2001 **Due Date:**_____ **Name(s):** _____

Project 11.4a: Polar Curves in Cartesian Coordinates

Objective

To illustrate how Maple can be used to plot polar curves in Cartesian coordinates.

Narrative

If you have not already done so, read Section 11.4 of the text.

The curve whose polar equation is $r = r(\theta), \theta \in [\alpha, \beta]$, can be plotted using the Cartesian coordinate parametrization

$$x = r\cos\theta = r(\theta)\cos\theta, \quad y = r\sin\theta = r(\theta)\sin\theta, \quad \theta \in [\alpha, \beta].$$

Tasks

1. a) Type the command lines below into Maple in the order in which they are listed. These commands plot the polar curve $r = 3\sin 2\theta, \theta \in [0, 2\pi]$.

```
> # Project 11.4a:  Polar Curves in Cartesian Coordinates
> restart;
> # Part a
> r := t -> 3*sin(2*t);
> plot([r(t)*cos(t),r(t)*sin(t),t=0..2*Pi],scaling=constrained);
```

   b) Continue by typing the command lines below into Maple in the order in which they are listed. These commands plot the polar curve $r = 2\cos 3\theta, \theta \in [0, 2\pi]$.

```
> # Part b
> r := t -> 2*cos(3*t);
> plot([r(t)*cos(t),r(t)*sin(t),t=0..2*Pi],scaling=constrained);
```

   At this time, make a hard-copy of your typed input and Maple's responses. Then, ...

2. a) On the graphic you created in part (a) of Task 1, label by hand:

   i) the points at which $t = 0, \pi/4, \pi/2, 3\pi/4, \pi, 5\pi/4, 3\pi/2, 7\pi/4, 2\pi$, and

   ii) the direction in which t increases from the point at which $t = 0$.

3. a) Referring to the graphic you created in part (b) of Task 1, what minimum range of t values produces a 3-leaf rose?

   b) On the graphic you created in part (b) of Task 1, label by hand:

   i) the points at which $t = 0, \pi/6, \pi/3, \pi/2, 2\pi/3, 5\pi/6, \pi$, and

   ii) the direction in which t increases from the point at which $t = 0$.

Comments

Some other interesting curves you might like to investigate include curves defined parametrically by $x(t) = r(t)\cos kt$, $y(t) = r(t)\sin kt$ where k is a real constant.