

Extra Project 11.4b: Limaçons

Objective

To investigate limaçons whose equations are of the form $r = 1 + c \cos \theta$.

Narrative

If you have not already done so, read Section 11.4 of the text. In particular, be sure to read about limaçons in Example 11 on p. 701 of the text. In that example, the author discusses limaçons with equations of the form $r = 1 + c \sin \theta$. In this project we investigate limaçons with equations of the form $r = 1 + c \cos \theta$.

Tasks

- a) Type the command lines below into Maple in the order in which they are listed. These commands plot the limaçons whose polar coordinate equations are of the form $r = 1 + c \cos \theta$ for $c = 0, 0.5, 1, 2$.

```
# Project 11.4b: Limaçons
> restart;
> r0 := t -> 1+0.0*cos(t);
> r1 := t -> 1+0.5*cos(t);
> r2 := t -> 1+1.0*cos(t);
> r3 := t -> 1+2.0*cos(t);
> plot([r0(t),t,t=0..2*Pi],[r1(t),t,t=0..2*Pi],[r2(t),t,t=0..2*Pi],
[r3(t),t,t=0..2*Pi],coords=polar,scaling=constrained);
```

- b) Continue by typing the command lines below into Maple in the order in which they are listed. These commands plot the limaçons whose polar coordinate equations are of the form $r = 1 + c \cos \theta$ for $c = 0, -0.5, -1, -2$.

```
> r0 := t -> 1-0.0*cos(t);
> r1 := t -> 1-0.5*cos(t);
> r2 := t -> 1-1.0*cos(t);
> r3 := t -> 1-2.0*cos(t);
> plot([r0(t),t,t=0..2*Pi],[r1(t),t,t=0..2*Pi],[r2(t),t,t=0..2*Pi],
[r3(t),t,t=0..2*Pi],coords=polar,scaling=constrained);
```

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

- a) Label each graph you plotted in part (a) of Task 1 with its constant c by hand: label the graph of $r = 1 + 0.5 \cos \theta$ by " $r = 1 + 0.5 \cos \theta$ ", for example.
- b) Label each graph you plotted in part (b) of Task 1 with its constant c by hand: label the graph of $r = 1 - 0.5 \cos \theta$ by " $r = 1 - 0.5 \cos \theta$ ", for example.