

Graphing Parametric Curves on the TI-83

These notes are specifically for the TI-83. Other Texas Instruments calculators may be similar. The notes assume that you already know how to graph functions of the form $y = f(x)$ – including resizing the viewing window, zooming in, moving the cursor along a curve, etc.

The TI-83 can draw graphs in rectangular (or “Cartesian”) coordinates (such as $y = f(x) = x^2$), parametric graphs (such as $x = f(t) = t$, $y = g(t) = t^2$), and polar coordinates (not used in Math 131).

Press the MODE key: the 4th line down reads *Func Par Pol Seq*

When *Func* is selected, the TI-83 is set in “rectangular coordinate mode”. To graph parametric equations, use the arrow keys to move down and over to highlight *Par*, and hit *ENTER* to switch to parametric mode. Use the keys *2nd-QUIT* to exit the *MODE* screen.

Press the Y= key to enter the curve to be graphed: For example, you would enter

$$\begin{array}{l} X_{1T} = \quad T \\ Y_{1T} = \quad T^2 \end{array}$$

to graph the parametric curve given by $x = t$, $y = t^2$. (The key labeled *X,T,θ,n* will automatically enter “T” in your formulas when you're in parametric mode).

You can use the entries $X_{2T} = \dots$ etc., to enter additional parametric curves

$$\begin{array}{l} X_{2T} = \\ Y_{2T} = \end{array}$$

Press the WINDOW key: just as when you do graphs in rectangular coordinates, you need to set the window size by choosing the values for *Xmin*, *Xmax*, *Ymin*, and *Ymax*. However, for parametric curves, you must also specify *Tmin*, *Tmax*, and *Tstep*.

For example, if you set $Tmin = -1$, $Tmax = 1$ and $Tstep = .1$, the TI-83 will start by computing (x, y) for $t = -1$ and continue through values $t = -0.9, -0.8, -0.7, \dots, .8, .9, 1$. Setting *Tmin* and *Tmax* too small may mean that some of the curve that should be visible in the window you chose won't be plotted; setting *Tmin* and *Tmax* too large may cause the calculator to plot a lot of points which won't show up because they lie outside your viewing window.

If *Tstep* is set too large, the points (x, y) that get plotted may be relatively far apart on screen, so that the resulting graph looks rather “jagged” or “angular”; but if *Tstep* is set too small, then the plotting is slowed down too much.

You need to think, and maybe experiment, to find the “best” settings in each particular problem.

Press the GRAPH key to draw the graph

Example: Draw the graph of the circle with parametric equations $x = \cos t$, $y = \sin t$ using the following different choices of settings:

$$Xmin=0, Xmax=2.8, Ymin=-1, Ymax=1, Tmin=0, Tmax=2\pi, Tstep=.1$$

$$Xmin=0, Xmax=2.8, Ymin=-1, Ymax=1, Tmin=0, Tmax=2\pi, Tstep=.6$$

$$Xmin=-1.4, Xmax=1.4, Ymin=-1, Ymax=1, Tmin=0, Tmax=\pi, Tstep=.1$$

$$Xmin=-1.4, Xmax=1.4, Ymin=-1, Ymax=1, Tmin=0, Tmax=2\pi, Tstep=.1$$

$$Xmin=-1.4, Xmax=1.4, Ymin=-1, Ymax=1, Tmin=0, Tmax=2\pi, Tstep=.01$$