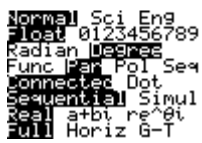
Graphing Projectile Motion

Using a special graphing technique it is possible to essentially “simulate” a projectile’s motion. Besides having a little fun with your calculator this activity should help increase your understanding of the component nature of projectiles. Follow these steps:

First you must set the graphing mode. Press the MODE button and choose Par or PARAMETRIC (instead of Func or FUNCTION – the typical graphing mode).

TI-82,83,84

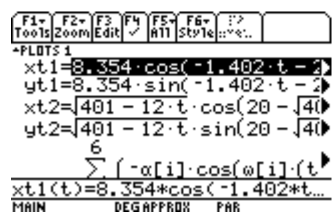


TI-89

Next press the Y= button to access the equation editing screen. Notice that there are now *pairs* of equations to graph. Each pair consists of two equations: x as a function of t and y as a function of t.

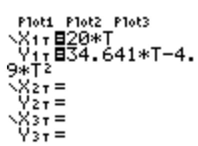
TI-82,83,84

TI-89

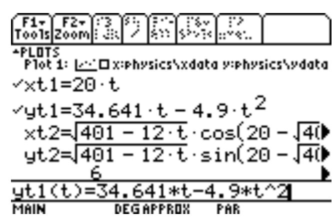


Enter the equations for the components of displacement: $d_x = v_{ix}t$ and $d_y = v_{iy}t + ½\, a_y t^2$. In the example shown below the components are those for an initial velocity of 40.0 m/s, 60.0º. Note: the variable in the equation is T or t (NOT x).

TI-82,83,84

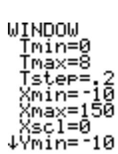


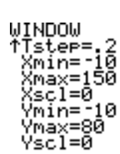
TI-89



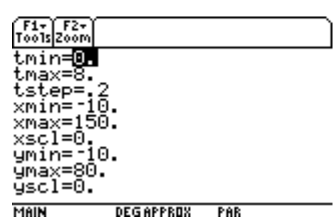
Before you graph the set of parametric equations it is a good idea to set up the WINDOW with appropriate limits for x and y based on the range and maximum height of the projectile. Notice also you enter a range of time values and a time step value – this controls how many points the calculator will plot on the graph.

TI-82,83,84



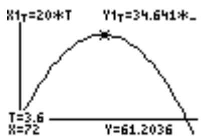


TI-89

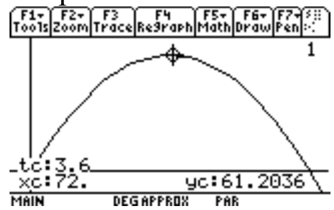


Now hit GRAPH. By using the TRACE function you can follow the path of the projectile, noting the components of its displacement at any particular point in time.

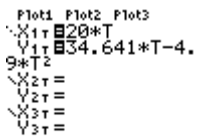
TI-82,83,84

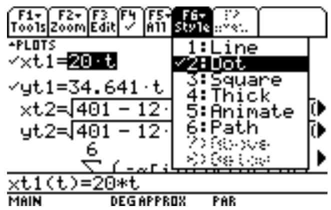


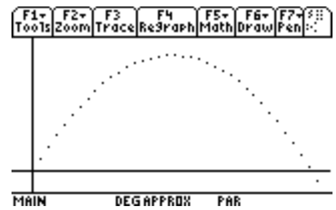
TI-89



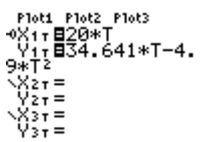
The calculator can plot the graph in a variety of ways. Use the Y= button and then choose the style of graphing. On TI-82,83,84 move the cursor to the far left and change the graphing style "icon". On TI-89 this is done under the Style menu.

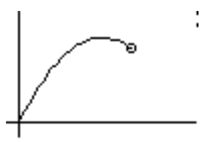


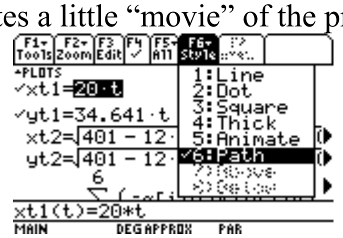


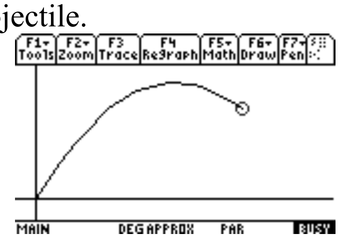


Here is another style, which basically creates a little "movie" of the projectile.









One more thing to try – modify the equations to find the components "automatically" and to allow for variables of initial speed and direction. Then you can simply enter initial speed and direction by using the button STO→ to store the values of *v* and *θ*. This allows you to experiment with the resulting trajectory.