PARAMETRIC EQUATIONS ON TI-Nspire Projectile Motion

A ball is projected at an initial speed of $u = 30$ m/s, making an angle $\alpha = 35^o$ with the horizontal. Assuming the acceleration due to gravity is $g = 9.8$ m/s^2 and ignoring air resistance the parametric equations for the motion of the ball can be written in terms of time t as:
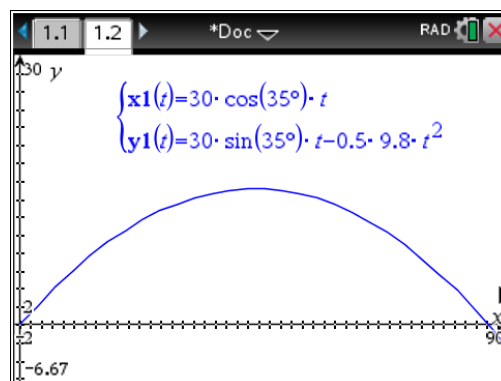
$$x = u\cos(\alpha)t$$

$$y = u\sin(\alpha)t - \frac{1}{2}gt^2$$

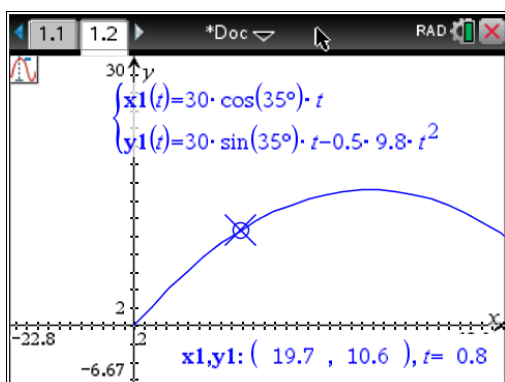Enter the above equations with the initial values on your calculator changing the Graph Entry to Parametric.

CASE 1

$$x = 30\cos(35^o)t$$

$$y = 30\sin(35^o)t - \frac{1}{2}(9.8)t^2$$

Sketch the graph setting the Window as suggested appropriately. Use Graph Trace to observe the motion of a ball. You can adjust *Tstep* in Window for a more accurate but slower Trace.

Hence answer the following questions:
1. Describe the motion of the ball.
2. Find the maximum height and when it occurs.
3. When and where does the ball land?
4. Where was the ball 2 seconds after the start?

Now vary the values of the initial speed and then of the angle of projection (one at a time) to see what effect they have on the maximum height and the maximum horizontal distance (called range).

For CASE 1, find the Cartesian equation of the path algebraically. Sketch the Cartesian path in Function entry, find the maximum height and range.

Q3 Chapter 15 Review

A ball is thrown into the air. The position of the ball at time $t \geq 0$ is given by the parametric equations $x = 10t$ and $y = 20t - 5t^2$.

a   Find the Cartesian equation of the ball's flight.

b   Sketch the graph of the ball's path.

c   What is the maximum height reached by the ball?

A second ball is thrown into the air. Its position at time $t \geq 0$ is given by the parametric equations $x = 60 - 10t$ and $y = 20t - 5t^2$.

d   Find the Cartesian equation of the second ball's flight.

e   Sketch the graph of the second ball's path on the same set of axes.

f   Find the points of intersection of the two paths.

g   Do the balls collide?