MT-A141 Precalculus Worksheet 9.1

Group: _____ Present: _____

1. On your graphing calculator, sketch the curve C defined by the parametric equations $X_{1T} = 0.1T\cos(T), Y_{1T} = 0.1T + \sin(T)$ for the following T ranges (use TSTEP= $\frac{\pi}{24}$ for all). Give viewing windows that show good graphs in each case.

(a) $T \in [0, 2\pi]$ Viewing window: [____, ____] × [____, ____]

(b) $T \in [-\pi, \pi]$ Viewing window: [____, ____] × [____, ____]

(c) $T \in [0, 9\pi]$ Viewing window: [____, ____] × [____, ____]

What do you conclude from this?

2. Graph the curve C with parametrization $x = t^2 + t, y = t^2 - t$ (use $t \in [-6, 6, 0.1]$). Find a good viewing window (use XSQUARE once you have a complete graph).

What shape is the curve? _____

Let's prove your claim! We need to eliminate t.

First, write $2(x + y)$ in terms of t: _____

Next, write $(x - y)^2$ in terms of t: _____

Equate: _____ = _____

Is this the equation of a curve of the type you stated?

3. What shape is the curve C with parametric equations $x = 4\cos(t), y = 3\sin(t)$ for $t \in [0, 2\pi, \frac{\pi}{24}]$?

(Be sure to use ZSQUARE)

Now prove your claim by eliminating t:

Equation: _____

4. Find the height function for a ball thrown upwards at 24 feet per second from the top of a 20 foot tower, using the data:

   $v_0 =$ _____ ft/sec $s_0 =$ _____ ft

   Thus the height of the ball is $s(t) =$ _____ feet after t seconds.

   Graph height vs. time: $X_{1T} = T, Y_{1T} = s(T) =$ _____

   Use your graph to find: The maximum height the ball attains = _____ feet after $t =$ _____ seconds;

   The ball strikes the ground after $t =$ _____ seconds; and

   Total distance ball travels = _____ + _____ = _____ feet.

5. The "Green Monster"at Fenway Park in Boston is a wall 37 feet high and 379 feet from home plate in one direction. If a ball is hit from 3 feet above home plate in that direction, at 123 feet per second at angle of elevation 32°, is it a home run? (That is, does it clear the Green Monster?) Let's investigate:

   Initial velocity vector: $\mathbf{v}_0 = v_{0x}\mathbf{i} + v_{0y}\mathbf{j} =$ _____

   Initial height $s_0 =$ _____ feet.

   Parametric equations for position of ball:

   $x =$ _____, $y =$ _____ $(\star)$

   Set your graphing calculator as follows: Mode: PARAMETRIC and SIMULTANEOUS, Viewing window: $T \in [0, 5, 0.1], X \in [0, 400, 50], Y \in [-30, 100, 10]$.

   Enter the path of the ball in X_{1T}, Y_{1T}. Graph the Green Monster as $X_{2T} = 379, Y_{2T} = 37T (T \leq 1)$. Use ZSQUARE.

   When, and at what height, does the ball hit the wall? (You will have to zoom in, and reduce TSTEP to solve this; alternatively, use the TABLE feature)

   Ball hits wall after $t =$ _____ seconds, at height _____ feet.

   Suppose now that the wind is "blowing out", for example, there is a 13.2 ft/sec (= 9 mph) wind in the direction the ball is going, which catches the ball after 1.5 seconds of flight. The effect of this is to add $13.2(T - 1.5)(T \geq 1.5)$ to the X_{1T} equation. Is the hit a home run?

   Go back to equation $(\star)$. Can you find an angle of elevation for the hit that produces a home run (without any wind)?

   $\theta =$ _____.