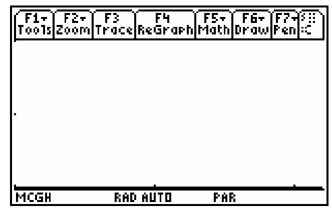
Assignment 22: Parametric Equations (9.1-3) **Name______________________**
Please provide a handwritten response.

1a. Graph $\begin{cases} x = \pi t - 0.6\,sin(\pi t) \\ y = 2t + 0.4\,sin(\pi t) \end{cases}$ on the graph provided below**.** From **MODE** set the graph option to **PARAMETRIC**. From ♦ **Y=** enter $xt1$ and $yt1$ as indicated.



$\mathbf{0 \le x \le 3.2,\ 0 \le y \le 2}$
$\mathbf{0 \le t \le 1}$

1b. Evaluate the function when $t = 0.5$ by evaluating $xt1(.5)$ and $yt1(.5)$. Mark this point on the curve above with a large dot and draw a line tangent to the curve at that point. What do you estimate the slope of this line to be? Record your estimate below.

1c. You can find this slope exactly on your calculator. From the graph press **F5 (MATH) 6** (**Derivatives)** and select **1** $\left(\frac{dy}{dx}\right)$ to find the slope at $t = 0.5$. Record the slope below.

1d. The formula for the length of arc of parametric equations is $L = \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\,dt$.

Find $\frac{dx}{dt}$ and $\frac{dy}{dt}$ by evaluating $d(xt1(t),t)$ and $d(yt1(t),t)$. Find the length of arc for this function from $t = 0$ to $t = 1$ and record your result below.

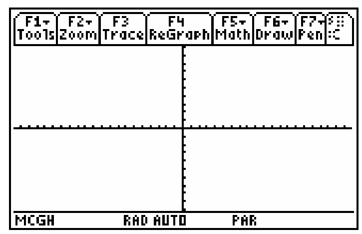
1e. If the above curve represents the path of an object, then the time to travel the path of the curve is given by the formula $T = \int k\sqrt{\frac{[g'(u)]^2 + [h'(u)]^2}{h(u)}}\,du$ where k is a constant greater than **0** (use $k = 1$), $x = g(u),\ y = h(u)$. Use u here instead of t to avoid confusion with time. Find the time needed to travel from $u = 0, ..., 1$. Record your results in the table below. When entering the formula use $h(u) = yt1(t)$.

1f. Repeat **1a, c-e** for $\begin{cases} x = \pi t \\ y = 2\sqrt{t} \end{cases}$ from $t = 0 \quad (0,0)$ to $t = 1 \quad (\pi, 2)$.

1g. Repeat **1a, c-e** for $\begin{cases} x = \pi t \\ y = 2\sqrt[4]{t} \end{cases}$ from $t = 0$ $(0,0)$ to $t = 1$ $(\pi, 2)$.

Exercise	Slope	Arc Length	Time
1e			
1f			
1g			

2a. Graph the parametric curve $\begin{cases} x = 8\cos(t) - 2\cos(4t) \\ y = 8\sin(t) - 2\sin(4t) \end{cases}$ over $-\pi \le t \le \pi$. Set the **tStep** at $\pi / 48$. Once the curve is drawn press **F2(Zoom) 5 (ZoomSqr)**. Do the two graphs look the same or different? Why?



ZOOM STANDARD to ZOOM SQUARE

2b. Locate the "corner" points of this curve. At such points $x'(t)$ and $y'(t)$ must both be zero. Trace and see if you can find these points. If you think you have found them check that $x'(t)$ and $y'(t)$ are both zero. If you cannot find them by tracing use **ZBOX** to zoom in on them and trace. Record your results below.