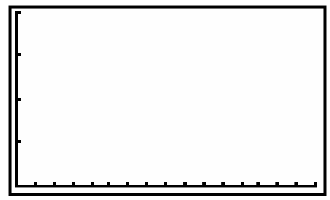
Assignment 21: Parametric Equations (9.1-3) **Name______________________**
Please provide a handwritten response.

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.**

	TI-83 Plus/TI-84 Plus	**TI-86**
GRAPHING PARAMETRIC EQUATIONS	**MODE** highlight **Par** Press **ENTER** **Y=** enter **x** and **y** as indicated.	**MODE** highlight **Param** Press **ENTER** **Y=** enter **x** and **y** as indicated.



$0 \le x \le 3.2,\ 0 \le y \le 2$
$0 \le t \le 1$, tStep =.1

1b. Evaluate the function when $t = 0.5$ (use $\mathbf{X_{1T}(0.5)}$ and $\mathbf{Y_{1T}(0.5)}$). $\mathbf{X_{1T}}$ and $\mathbf{Y_{1T}}$ are found in the **VARS** menu (**Y-VARS Parametric** option on the TI-83 Plus/TI-84 Plus or **EQU** option on the TI-86). 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.

	TI-83 Plus/TI-84 Plus	**TI-86**
PARAMETRIC GRAPHING ACTIVITIES	**MODE Par** **2ND TRACE (CALC)** **2 dy/dx** gives the slope. Note that option **1** could have been used in **1b**.	**(GRAPH) MORE MATH** **F2 dy/dx** gives the slope. Note that you could have used (**GRAPH) MORE MORE F1 (EVAL)** in **1b**.

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 hand. Find the length of arc for this function and record your result below. (On the TI-86 compare your answer with the answer obtained from **(GRAPH) MORE MATH F5 (arc)** by entering **left bound =0** and **right bound = 1**. Is it the same?)

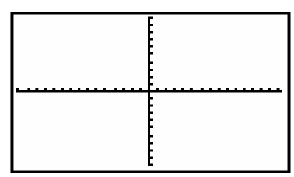
1e. If the above curve represents the path of an object, then the time needed to travel the path of the curve is given by the formula $\boldsymbol{T} = \int \boldsymbol{k}\sqrt{\frac{\left[g'(u)\right]^2 + \left[h'(u)\right]^2}{h(u)}}\,\boldsymbol{du}$ where $\boldsymbol{k}$ is a constant greater than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

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

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

Exercise	Slope	Arc Length	Time
1e			
1f			
1g			

2a. Graph the parametric curve $y = \begin{cases} x = 8\cos(t) - 2\cos(4t) \\ y = 8\sin(t) - 2\sin(4t) \end{cases}$ over $-\pi \le t \le \pi$. Set the **tStep** at $\pi / 48$. Once the curve is drawn press **ZOOM ZSQR** (Zoom Square). 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 you can use **ZBOX** to zoom in on them and trace to find them. Record your results below.