Parametric Equations
Section 10.2c

Yesterday, we looked at graphing parametric equations without a calculator. Today, we’ll use a graphing calculator to graph parametric equations. We have to be VERY careful when we are using a graphing calculator to graph parametric equations. We need to pay attention to:

1. Where the parametric equation starts, and which direction it travels.
2. if the parametric equation changes direction on the graph.
3. if the parametric equation traces the graph more than once.

Consider this set of parametric equations:

\[ x = t^3 - 2t + 1 \]
\[ y = -2t + 4 \]

Fill out the table below using a graphing calculator, but graph the parametric equations beginning with \( t = -2 \) and ending with \( t = 2 \) WITHOUT using a graphing calculator.

<table>
<thead>
<tr>
<th>( t )</th>
<th>( x = t^3 - 2t + 1 )</th>
<th>( y = -2t + 4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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Now, we’ll use the graphing calculator! To set up your calculator for parametric equations, press MODE and change FUNC to PAR. Then go to Y= and enter in the equations above. Go to WINDOW to set minimums and maximums for \( t \), \( x \), and \( y \). A good choice for Tstep is 0.1.

Now let’s play! Change Tstep to 0.01, 0.5, 1, 2 and see what happens.
When I change the Tstep to 0.01, ______________________________________
______________________________________________________________________________
When I change the Tstep to 0.5, _________________________________________
______________________________________________________________________________
When I change the Tstep to 1, ________________________________________
______________________________________________________________________________
When I change the Tstep to 2, ________________________________________
______________________________________________________________________________

Restore the Tstep to .1 and try changing Tmin and Tmax.
What happens when you change Tmin and Tmax? _____________________
______________________________________________________________________________

On your graphing calculator,

graph this set of equations:

\[
\begin{align*}
x_{IT} &= \cos T \\
y_{IT} &= \sin T
\end{align*}
\]

Go to WINDOW and set:
T to \([0, 2\pi]\)
Tstep to \(\frac{\pi}{24}\),
\(x \in [-2, 2]\)
\(y \in [-1.5, 1.5]\)

Copy this graph to the grid at right.
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Now, change $T$ to $[-2\pi, 2\pi]$ and choose the “moving ball” or “animate” or “path” option for graphing, then graph the equation again. What is different? __________________________________________________
______________________________________________________________________________