

Parameterized Curves

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Objective

To illustrate how Mathematica can be used to plot parametrized curves.

Narrative

To plot the planar curve whose parametric equations are $x = x(t), y = y(t), t \in [a, b]$ using Mathematica, we use the command “**ParametricPlot**[{**x(t),y(t)**}, {**t,a,b**}]”. To plot this curve on a set of coordinate axes whose aspect ratio is 1, we use “**ParametricPlot**[{**x(t),y(t)**}, {**t,a,b**}, **AspectRatio -> 1**]”.

Task

1. Type the command lines below into Mathematica in the order in which they are listed. These commands draw the graphs of the parameterized curves:

- a) $x = 8t - 3, y = 2 - t, t \in [0, 1]$
- b) $x = 5 \sin t, y = 3 \cos t, t \in [0, 2\pi]$
- c) $x = \sin 3t, y = \sin 4t, t \in [0, 2\pi]$
- d) $x = t + \sin 3t, y = t + \sin 4t, t \in [-2\pi, 2\pi]$
- e) $x = \cos t, y = \sin(t + \sin 5t), t \in [-2\pi, 2\pi]$

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In[1] := (* Your name, today's date *)
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In[2] := (* Parameterized Curves *)
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In[3] := ParametricPlot[{8t-3, 2-t}, {t,0,1}, AspectRatio->1]
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In[4] := ParametricPlot[{5Sin[t], 3Cos[t]}, {t,0,2Pi}, AspectRatio->1]
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In[5] := ParametricPlot[{Sin[3t], Sin[4t]}, {t,0,2Pi}, AspectRatio->1]
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In[6] := ParametricPlot[{t+Sin[3t], t+Sin[4t]}, {t,-2Pi,2Pi}, AspectRatio->1]
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In[7] := ParametricPlot[{Cos[t], Sin[t+Sin[5t]]}, {t,-2Pi,2Pi}, AspectRatio->1]
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2. Create a graphic of a parameterized curve (other than one of those above) that you find interesting. (See the Comment below.)

At this time, make a hard-copy of your typed input and Mathematica's responses. Then:

3. For each graphic you created in Task 1, plot and label the point at which $t = 0$. Then draw a small arrow next to the curve that points in the direction of increasing t . If the curve has more than one loop, draw a small arrow next to each loop in the direction of increasing t .

Your lab report will be a hard-copy of your typed input and Mathematica's responses (both text and hand-labeled graphics).

Comments

The ability to graph parametric curves so easily in Mathematica, and the fact that there are few restrictions on what makes the graph of a set of parametric equations interesting, take the graphing of parametric equations from a topic in Calculus to an art form. It's interesting, for example, to see how changes to a given set of parametric equations affect the graph of the curve, or what happens when you try to invent something of your own. Remember: anything goes! And, in general, the more complex your equations the more interesting its graph will likely be!