Animations For Parametric Equations in 2 - space

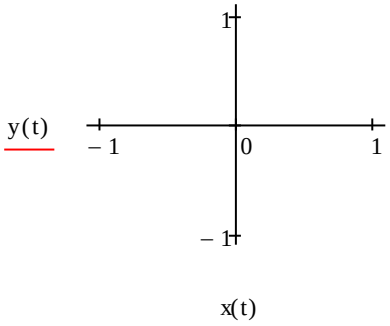
Suppose we want generate the unit circle. (This method will work for any set of parametric equations x= x(t) and y = y(t))

1. As always we start by fixing the axes on the graph. For more complicated examples you can always graph the curve first to determine the limits.

Start by setting the graph with a range of -1.1 to 1.1 on both the horizontal and vertical. I always go a little more and a little less than needed.

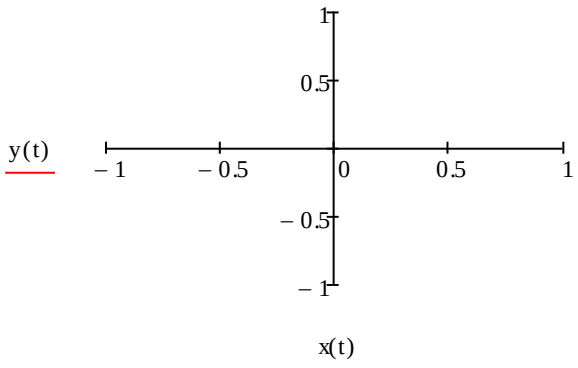
2. $t := 0, \frac{\pi}{48} .. \frac{\pi}{48} \cdot FRAME$ defines the range variable - with trig functions I usually use an increment of $\frac{\pi}{48}$ with algebraic functions I usually use .1.

3. Define $x(t) := \cos(t)$ and $y(t) := \sin(t)$ and put x(t) in the placeholder on the horizontal and y(t) in the placeholder on the vertical.



Summary of actual format: (Pretty Simple when you know what you're doing)

$t := 0, \frac{\pi}{48} .. \frac{\pi}{48} \cdot FRAME \quad x(t) := \cos(t) \quad y(t) := \sin(t)$



4. Now we are ready to animate. The circle is generated as t varies from 0 to 2π we will use

96 frames as $\frac{\pi}{48}\cdot 96 = 2\cdot\pi$. I would probably use an animation speed of 4frames/sec but again this depends solely on the animator and the specific example.

Suppose we want to view the leading point as the circle is generated.

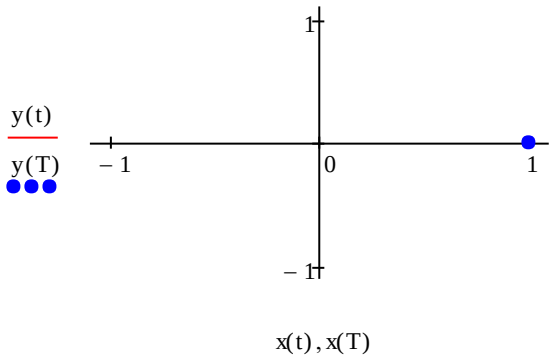
Define $T := \frac{\pi}{48}\cdot FRAME$ and put y(T) on the vertical and x(T) on the horizontal

For Trace 2 change lines to points and add a symbol. If you want to see the actual coordinates type T = , x(T) = and y(T) = or if you want the symbolic use (ctrl-period) - enter

Complete Format:

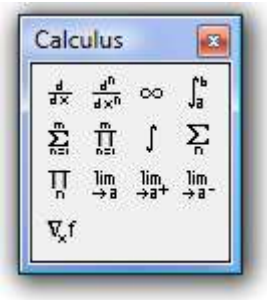
$$t := 0, \frac{\pi}{48} .. \frac{\pi}{48}\cdot FRAME \qquad x(t) := \cos(t) \quad y(t) := \sin(t) \qquad T := \frac{\pi}{48}\cdot FRAME$$

$$T \to 0 \qquad x(T) \to 1 \qquad y(T) \to 0$$



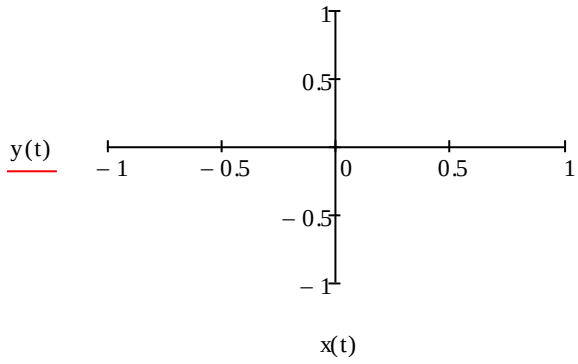
$x(t), x(T)$

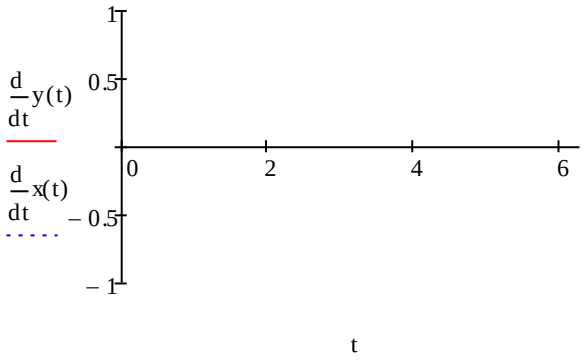
Now Let's add the derivatives. From the Calculus Menu with icon 



Choose the $\frac{d}{dx}$ icon and create a second graph with both $\frac{dx}{dt}$ and $\frac{dy}{dt}$ on the vertical and t in the place holder on the horizontal as we want to see how the derivatives progress in time. Fix the horizontal to go from 0 to 2π on the derivative graph.

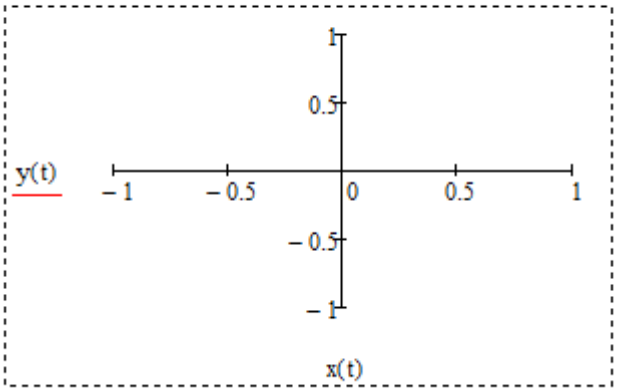
$t := 0, \frac{\pi}{48} .. \frac{\pi}{48} \cdot \text{FRAME}$ $x(t) := \cos(t)$ $y(t) := \sin(t)$

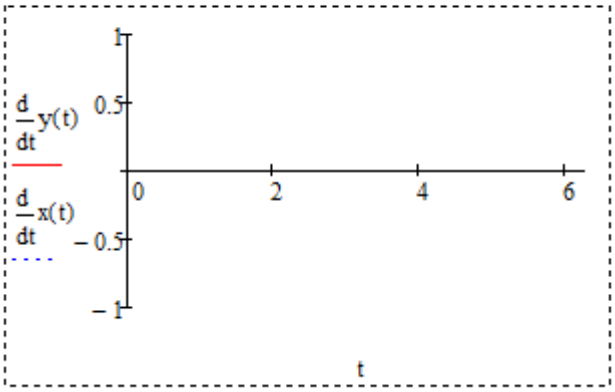




Again make sure you fix the axes before animation. When you animate highlight everything.

$t := 0, \frac{\pi}{48} .. \frac{\pi}{48} \cdot FRAME \quad x(t) := \cos(t) \quad y(t) := \sin(t)$





A very useful tool

In several examples we'll want to parameterize line segments from 2pts (x_0, y_0) to (x_1, y_1).

We can do this by using :

$t := 0, .1 .. 1$

$x(t) := x_0 + (x_1 - x_0) \cdot t$

$y(t) := y_0 + (y_1 - y_0) \cdot t$