

Animation for an Ellipse

For our example we'll use the ellipse

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

First we need to parameterize the ellipse

$t := 0, .1..2 \cdot \pi$ Later we'll change the 2π to FRAME ($\pi/48$) but for now to see how everything

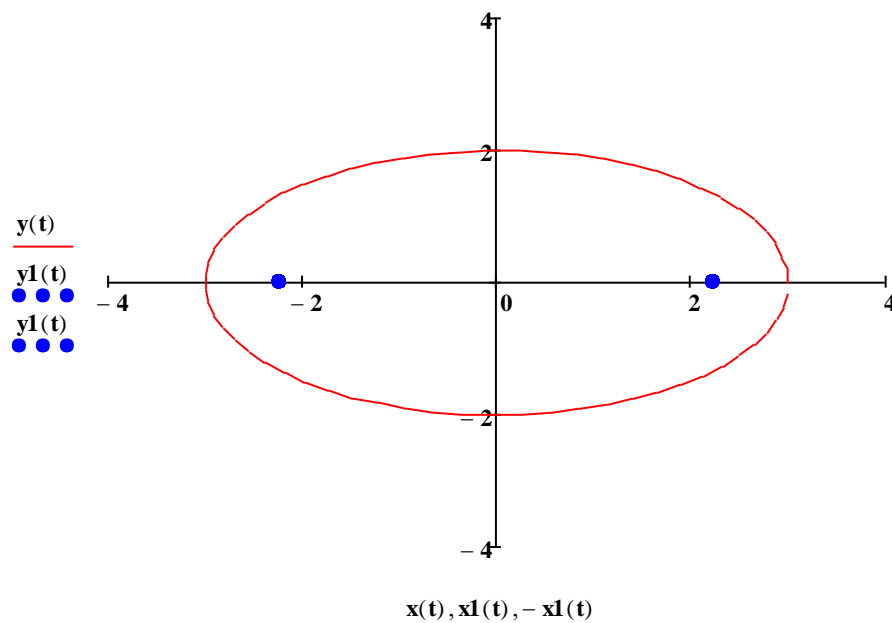
will look we'll use 2π

$$x(t) := 3 \cdot \cos(t) \quad y(t) := 2 \cdot \sin(t)$$

Next we'll plot the foci:

$$x1(t) := \sqrt{5} \quad y1(t) := 0 \quad \text{change plots 2 and 3 to points and add a symbol}$$

We plot $y1(t)$ twice on the vertical and $x1(t)$ and $-x1(t)$ on the horizontal



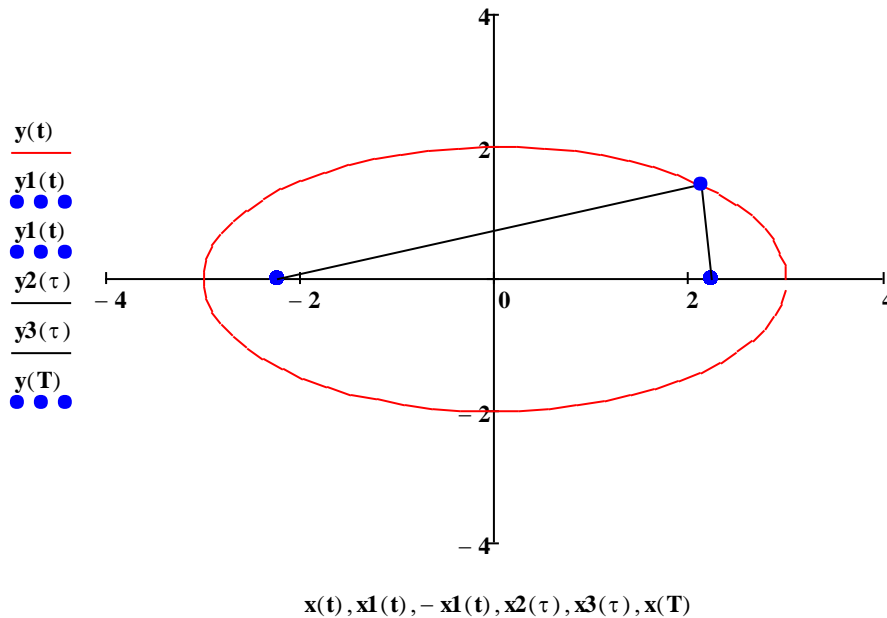
We need the parametric equations of the line segments from the foci to a point (x,y) on the graph. We'll also put in the point on the graph -- we can simply use x(T) and y(T)

$\mathbf{T} := \frac{\pi}{4}$ Again later we'll change this to FRAME($\pi/48$) . $\tau := 0..1$

$$\mathbf{x2}(\tau) := \sqrt{5} + (\mathbf{x}(\mathbf{T}) - \sqrt{5}) \cdot \tau \quad \mathbf{y2}(\tau) := (\mathbf{y}(\mathbf{T})) \cdot \tau$$

$$\mathbf{x3}(\tau) := -\sqrt{5} + (\mathbf{x}(\mathbf{T}) + \sqrt{5}) \cdot \tau \quad \mathbf{y3}(\tau) := (\mathbf{y}(\mathbf{T})) \cdot \tau$$

Change plots 4 and 5 solid and make the color black
Change plot 6 to points and add a symbol.



The last things we'll add are the functions which calculate the distances from the foci to the point (x(T),y(T))

$$\mathbf{d1}(\mathbf{T}) := \sqrt{(\mathbf{x}(\mathbf{T}) - \sqrt{5})^2 + \mathbf{y}(\mathbf{T})^2} \quad \mathbf{d2}(\mathbf{T}) := \sqrt{(\mathbf{x}(\mathbf{T}) + \sqrt{5})^2 + \mathbf{y}(\mathbf{T})^2}$$

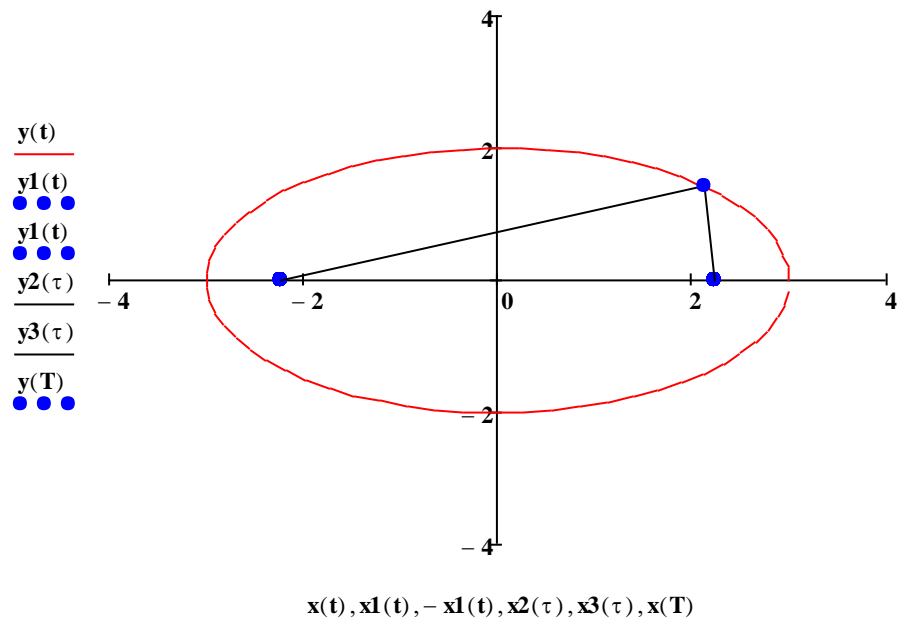
For the evaluation of T uses T (ctrl-period) enter to get T in multiples of π . For a single frame it will appear as follows:

$$T \rightarrow \frac{\pi}{4}$$

$$d1(T) = 1.419$$

$$d2(T) = 4.581$$

$$d1(T) + d2(T) = 6$$



Now let's put it all together

$$t := 0, .1..FRAME\left(\frac{\pi}{48}\right)$$

$$\underline{x}(t) := 3 \cdot \cos(t) \quad \underline{y}(t) := 2 \cdot \sin(t)$$

$$\underline{x1}(t) := \sqrt{5} \quad \underline{y1}(t) := 0$$

$$\mathbf{T} := \text{FRAME}\left(\frac{\pi}{48}\right) \quad \tau := 0..1$$

$$\mathbf{x2}(\tau) := \sqrt{5} + (\mathbf{x}(\mathbf{T}) - \sqrt{5}) \cdot \tau \quad \mathbf{y2}(\tau) := (\mathbf{y}(\mathbf{T})) \cdot \tau$$

$$\mathbf{x3}(\tau) := -\sqrt{5} + (\mathbf{x}(\mathbf{T}) + \sqrt{5}) \cdot \tau \quad \mathbf{y3}(\tau) := (\mathbf{y}(\mathbf{T})) \cdot \tau$$

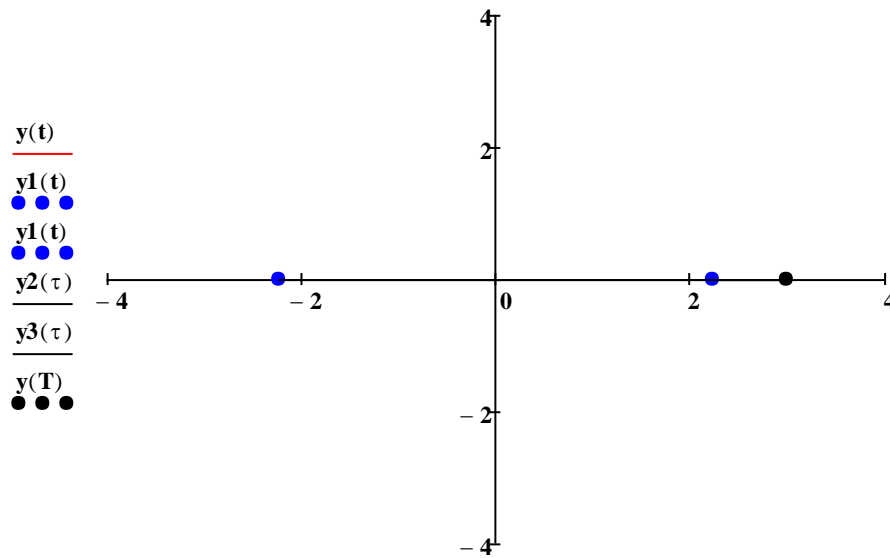
$$\mathbf{d1}(\mathbf{T}) := \sqrt{(\mathbf{x}(\mathbf{T}) - \sqrt{5})^2 + \mathbf{y}(\mathbf{T})^2} \quad \mathbf{d2}(\mathbf{T}) := \sqrt{(\mathbf{x}(\mathbf{T}) + \sqrt{5})^2 + \mathbf{y}(\mathbf{T})^2}$$

$\mathbf{T} \rightarrow 0$

$\mathbf{d1}(\mathbf{T}) = 0.764$

$\mathbf{d2}(\mathbf{T}) = 5.236$

$\mathbf{d1}(\mathbf{T}) + \mathbf{d2}(\mathbf{T}) = 6$



$\mathbf{x}(t), \mathbf{x1}(t), -\mathbf{x1}(t), \mathbf{x2}(\tau), \mathbf{x3}(\tau), \mathbf{x}(\mathbf{T})$