Format for incoming and outgoing light rays reflected off a parabolic mirror

$f(x) := \frac{x^2}{4}$ defines the equation of the mirror with focal point at (0,1)

So now we define the equations of the incoming light rays.

$t := 0, .1 .. 2$ Later to animate we'll change 2 to FRAME/10 but for now we'll use 2 to show on the graph the situation.

In the x direction we want vertical lines, i.e. a constant value of x, until the light rays hit the mirror . Once they hit the mirror at t = 1 then the light ray goes from the x coordinate of the mirror to 0 between t = 1 and t = 2.

For example at x = 1

$$X(t) = 1 + \Phi(t-1)\cdot(1-t).$$

at x= 2 $X(t) = 2 + \Phi(t-1)\cdot(2-2t)$ and so on.

We don't have to define several functions we only need one:

$$X(t,n) := n + \Phi(t-1)\cdot[n\cdot(1-t)]$$

In the y direction we start all of the light rays at y = 4 . Then y decreases until the light ray hits the mirror at t= 1

then goes from the y- coordinate of the mirror to the y coordinate of the focal point i.e. 1 between t = 1 and t = 2.

For example when x = 1 we have the light ray going from 4 to 1/4 at t = 1 to y = 1 at t = 2.

$$Y(t) = 4 + \left(\frac{1}{4} - 4\right)\cdot t + \Phi(t-1)\cdot\left[\frac{1}{4} + \left(1 - \frac{1}{4}\right)\cdot(t-1) - \left[4 + \left(\frac{1}{4} - 4\right)\cdot t\right]\right]$$

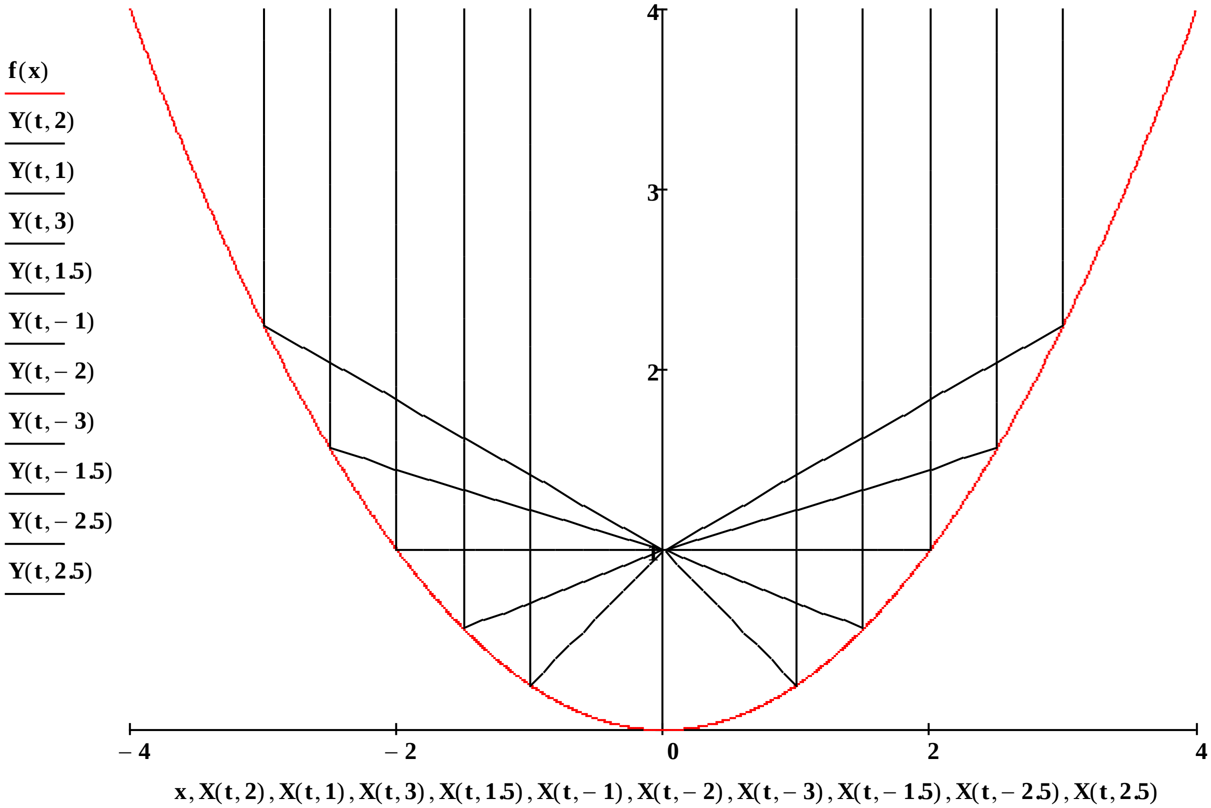
when x = 2

$$Y(t) = \left[\left[4 + \left(\frac{2^2}{4} - 4\right)\cdot t\right] + \Phi(t-1)\left[\frac{2^2}{4} + \left(1 - \frac{2^2}{4}\right)\cdot(t-1) - \left[4 + \left(\frac{2^2}{4} - 4\right)\cdot t\right]\right]\right]$$

Again we can define a single function:

$$Y(t,n) := \left[4 + \left(\frac{n^2}{4} - 4\right)\cdot t\right] + \Phi(t-1)\left[\frac{n^2}{4} + \left(1 - \frac{n^2}{4}\right)\cdot(t-1) - \left[4 + \left(\frac{n^2}{4} - 4\right)\cdot t\right]\right]$$

The graph would then be set up as :



To set up the animation then we would have:

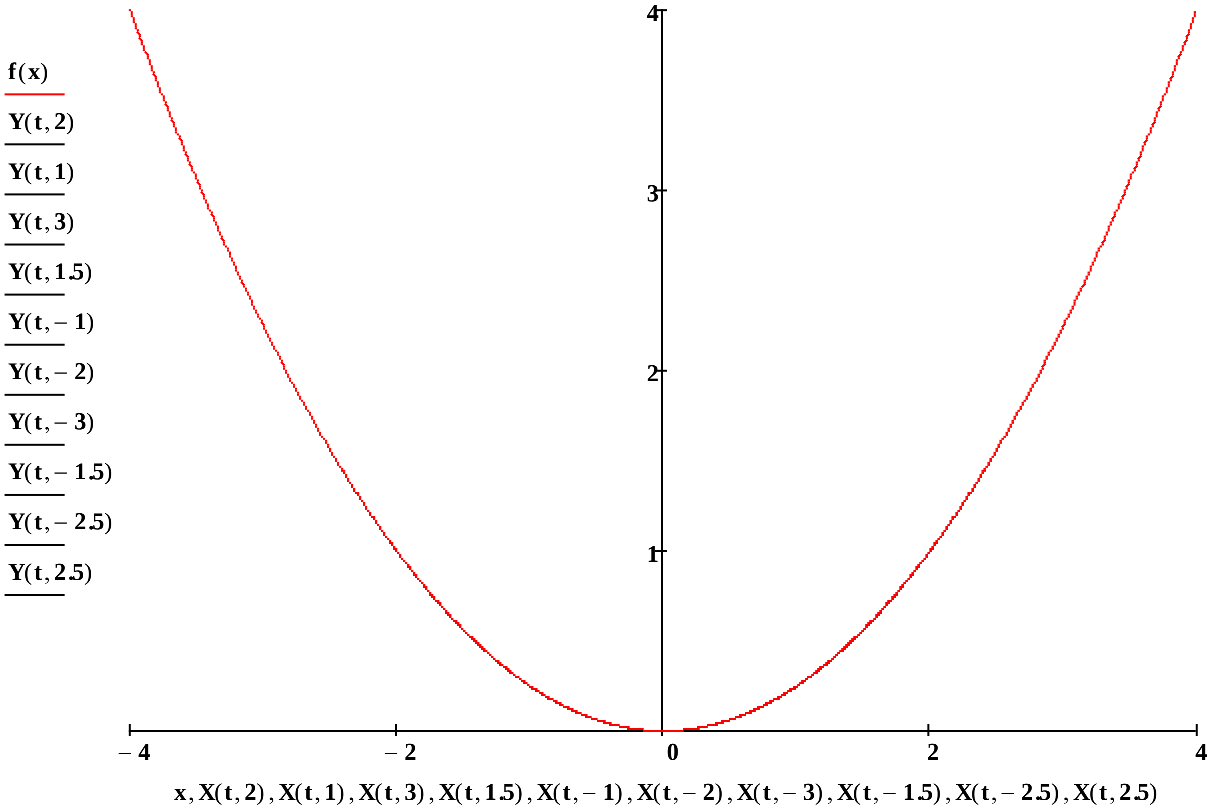
$$f(x) := \frac{x^2}{4}$$

$$t := 0, .1 .. \frac{FRAME}{10}$$

$$X(t, n) := n + \Phi(t-1)\cdot[n\cdot(1-t)]$$

$$Y(t, n) := \left[4 + \left(\frac{n^2}{4} - 4\right)\cdot t\right] + \Phi(t-1)\left[\frac{n^2}{4} + \left(1 - \frac{n^2}{4}\right)\cdot(t-1) - \left[4 + \left(\frac{n^2}{4} - 4\right)\cdot t\right]\right]$$

We would use 20 frames.

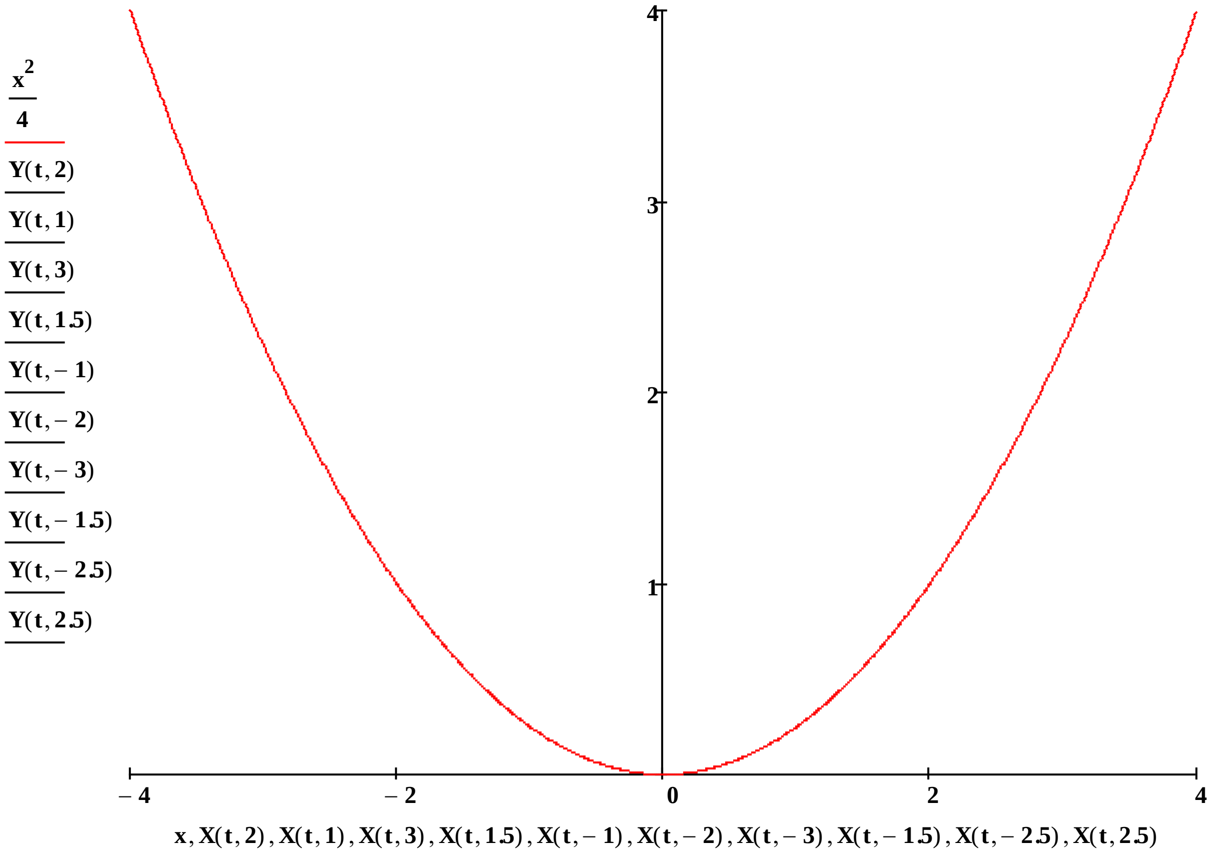


For outgoing light rays emanating from the focal point then being reflected from the mirror vertically we have

$$t := 0, .1 .. \frac{FRAME}{10}$$

$$X(t, n) := n \cdot t + \Phi(t - 1) \cdot (n - n \cdot t)$$

$$Y(t, n) := \left[\left[1 + \left(\frac{n^2}{4} - 1\right) \cdot t\right] + \Phi(t - 1)\left[\frac{n^2}{4} + \left(1 - \frac{n^2}{4}\right) \cdot (t - 1) - \left[4 + \left(\frac{n^2}{4} - 4\right) \cdot t\right]\right]\right]$$



Incoming $\quad t := 0, .1 .. \frac{FRAME}{10}$

$X(t, n) := n + \Phi(t-1) \cdot [-n \cdot (t-1)]$

$$\mathbf{Y(t,n)} := \left[\left[5+\left(\frac{n^2}{4}-5\right)\cdot t\right]+\Phi(t-1)\left[\frac{n^2}{4}+\left(1-\frac{n^2}{4}\right)\cdot(t-1)-\left[5+\left(\frac{n^2}{4}-5\right)\cdot t\right]\right]\right.$$