Embedding images into a plot

img2xy

`img2xy(M, ch, sz, a)`	Plots the image in M with characters ch with size sz and transparency color a into a native SMath plot
`img2xy(M, a)`	Plots the image in M with transparency color a into a XY plot plugin

Example: LogSpiral

Example: Logarithmic spiral

Nautilus shell

$M := \text{image2rgb}(\text{"Nautilus.jpg"})$ $\quad \text{Clear}(a, b) = 1$

Read this values from the graph

$xo := 68$ $\quad yo := 89$ for $O := [xo\ yo]$ $\quad f(-\infty) = O$

$xa := 174$ $\quad A := [xa\ yo]$ $\quad f(0) = A$

$xb := 103$ $\quad B := [xb\ yo]$ $\quad f(2\cdot\pi) = B$

Logarithmic spiral equation

$$f(t) := a \cdot b^{t} \cdot [\cos(t) - \sin(t)] + [xo\ yo]$$

Solving numerically

$$a := \text{eval}\left(\text{roots}\left(\overrightarrow{f(0)}_1 - xa, a\right)\right) \qquad a = 106$$

$$b := \text{eval}\left(\text{roots}\left(\overrightarrow{f(2\cdot\pi)}_1 - xb, b, 1\right)\right) \qquad b = 0.8383$$

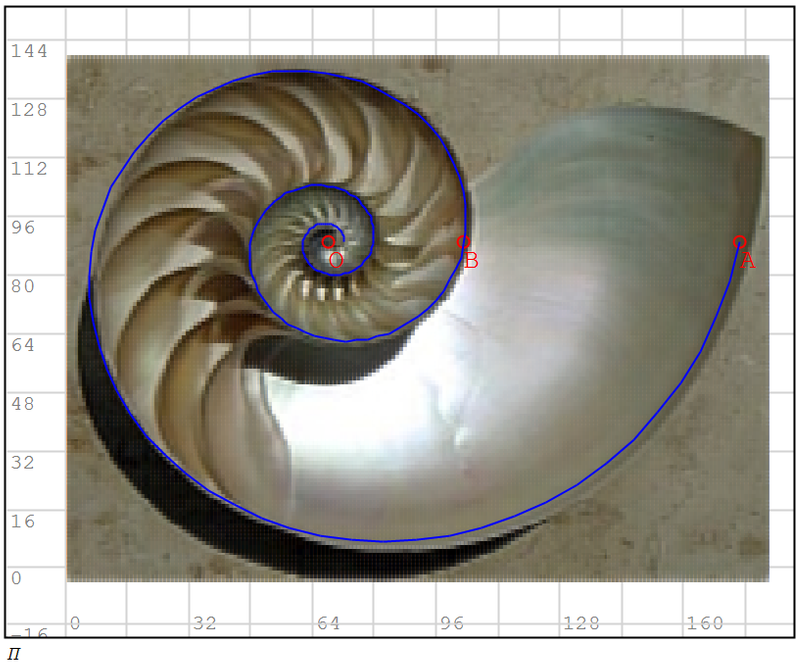
Or by hand

$$f(0) = a \cdot [1\ 0] + [xo\ yo] = [xa\ yo] \quad \text{thus} \quad a := xa - xo = 106$$

$$f(2\cdot\pi) = a \cdot b^{2\cdot\pi} \cdot [1\ 0] + [xo\ yo] = [xb\ yo] \quad b := \sqrt[2\cdot\pi]{\frac{xb - xo}{a}} = 0.8383$$

Plot in SMath

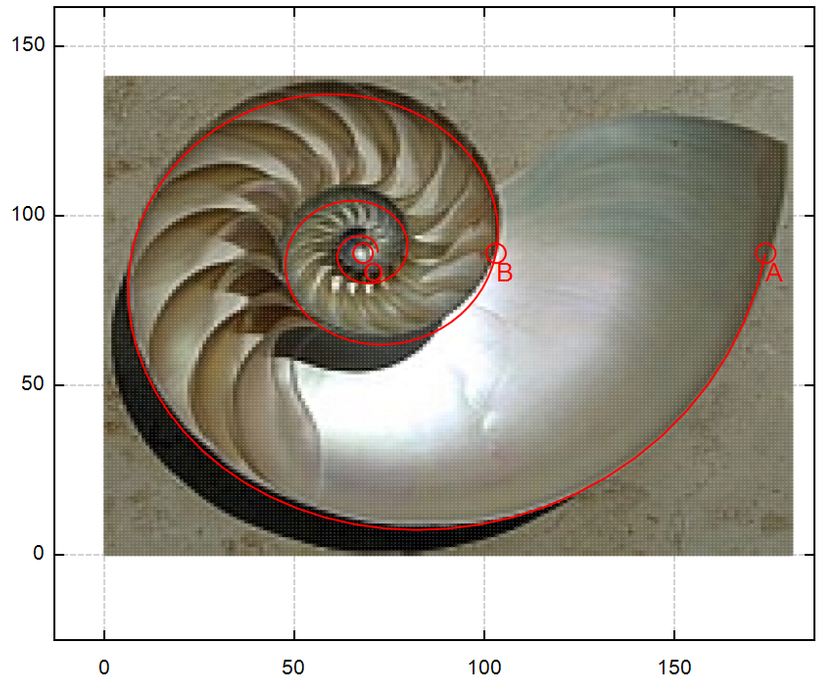
```
XY := matrix(0, 2)
for t ∈ [0, 0.1..(6·π)]
  XY := eval(stack(XY, f(t)))
Π := XY
     Point("A")
     Point("B")
     Point("O")
     img2xy(M, "", 4, 0.6)
```



Π

Plot in XY plugin.

$$\Pi := \begin{cases} img2xy(M, 0.8) \\ Point("A") \\ Point("B") \\ Point("O") \\ XY \end{cases}$$



Π

Image in this sample:

Example: Catenary

Example: Catenary

We use here the grayscale of the image.

Budapest Keleti Railway Station

$M := \text{image2rgb}("Budapest\_Keleti\_teto.jpg")$ $GS := \frac{1}{3} \cdot \left(\sum M \right)$ Imag http

Read this points in the graph

$A := [\,8 \;\; 64\,]$ $O := [\,82 \;\; 114\,]$ $\text{Clear}(a, xo, yo) = 1$

Catenary equation

$f(x) := a \cdot \cosh\left(\frac{x - xo}{a} \right) + yo$ with $xo := O_1$ $yo := A_2 + O_2$

Find a

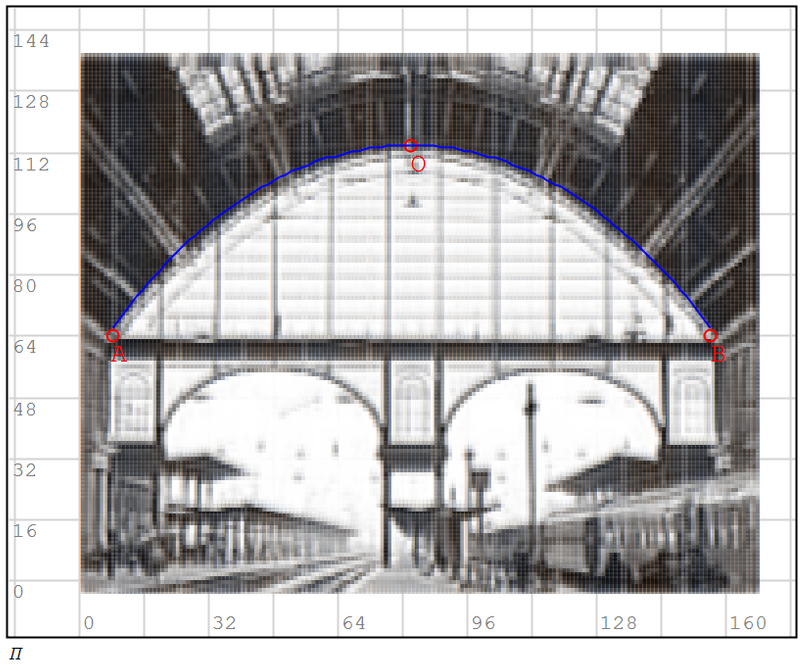
$a := \text{eval}\left(\text{roots}\left(f(O_1) = O_2, a, -50 \right) \right) = -64$

Plot in SMath

$$B := \left[2 \cdot O_1 - A_1 \;\; A_2 \right]$$

$$X := A_1 + \frac{B_1 - A_1}{100} \cdot [0..100]$$

$$\Pi := \begin{cases} \text{augment}\left(X, \overrightarrow{f(X)} \right) \\ Point("A") \\ Point("B") \\ Point("O") \\ img2xy(GS, "\blacksquare", 4, 0.4) \end{cases}$$

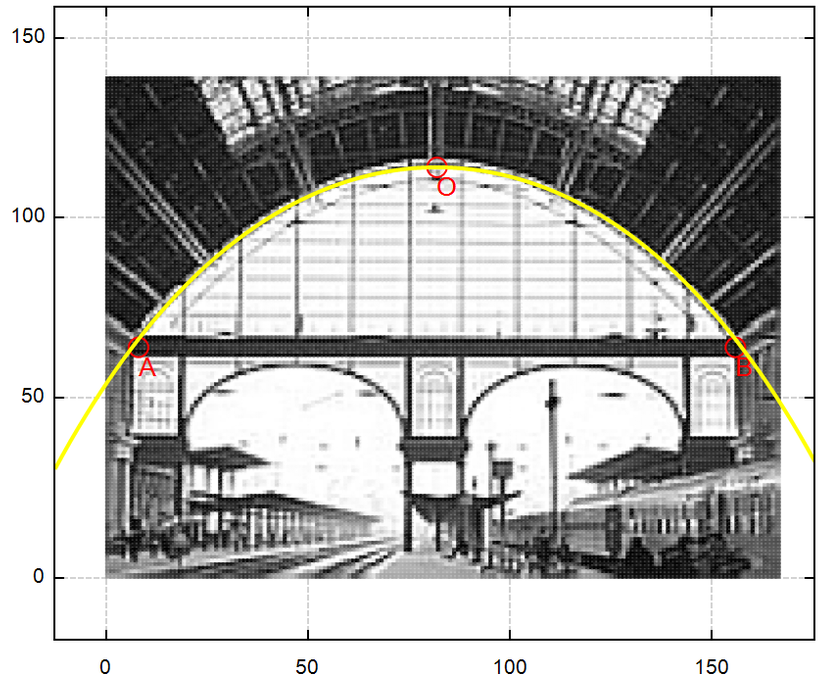


Π

Plot in XY plugin.

$$\Pi := \begin{cases} img2xy(GS, 0.8) \\ Point("A") \\ Point("B") \\ Point("O") \\ f(x) \end{cases}$$

Image in this sample:



Π

Alvaro