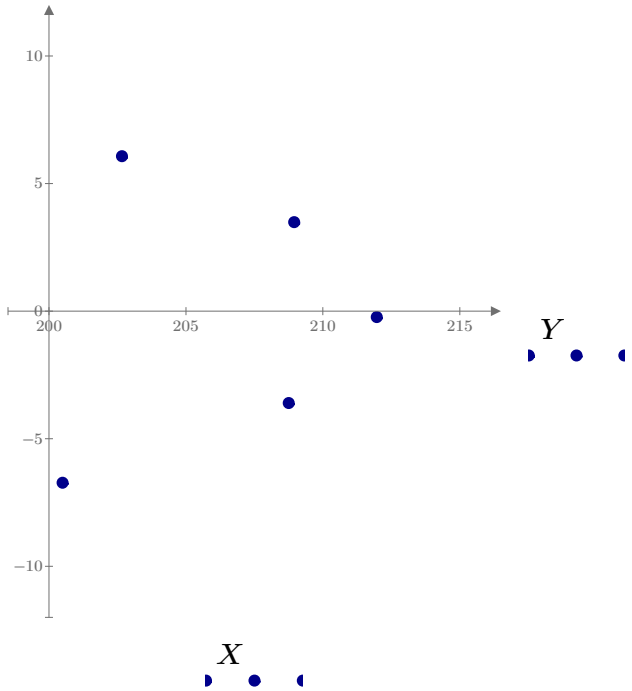
$a := 212$ $e := 0.995125$ https://en.wikipedia.org/wiki/Great_Comet_of_1811

$b := a \cdot \sqrt{1 - e^2} = 20.908$ $c := a \cdot e = 210.967$

$$X := \begin{bmatrix} 202.662572911686 \\ 208.952538616392 \\ 211.966669674178 \\ 208.751324696265 \\ 200.49273138321 \end{bmatrix} \qquad Y := \begin{bmatrix} 6.07060831977258 \\ 3.48650425174498 \\ -0.232488037752813 \\ -3.59964263161568 \\ -6.72285224432161 \end{bmatrix}$$



$a_{x2} \cdot x^2 + a_{y2} \cdot y^2 + 2\ a_{xy} \cdot x \cdot y + 2\ a_x \cdot x + 2\ a_y \cdot y + a_0 = 0$ $a_0 := -1$

$$M := \begin{bmatrix} X_0^2 & 2X_0Y_0 & Y_0^2 & 2X_0 & 2Y_0 \\ X_1^2 & 2X_1Y_1 & Y_1^2 & 2X_1 & 2Y_1 \\ X_2^2 & 2X_2Y_2 & Y_2^2 & 2X_2 & 2Y_2 \\ X_3^2 & 2X_3Y_3 & Y_3^2 & 2X_3 & 2Y_3 \\ X_4^2 & 2X_4Y_4 & Y_4^2 & 2X_4 & 2Y_4 \end{bmatrix} \qquad v := \begin{bmatrix} -a_0 \\ -a_0 \\ -a_0 \\ -a_0 \\ -a_0 \end{bmatrix} \qquad \|M\| = 5.236 \cdot 10^8$$

$$\begin{bmatrix} a_{x2} \\ a_{xy} \\ a_{y2} \\ a_x \\ a_y \end{bmatrix} := \text{lsolve}(M, v) = \begin{bmatrix} 2.22026528830049 \cdot 10^{-5} \\ 2.36957338783686 \cdot 10^{-9} \\ 2.33038147074521 \cdot 10^{-3} \\ 5.45311866520085 \cdot 10^{-6} \\ -4.93272188657136 \cdot 10^{-7} \end{bmatrix}$$

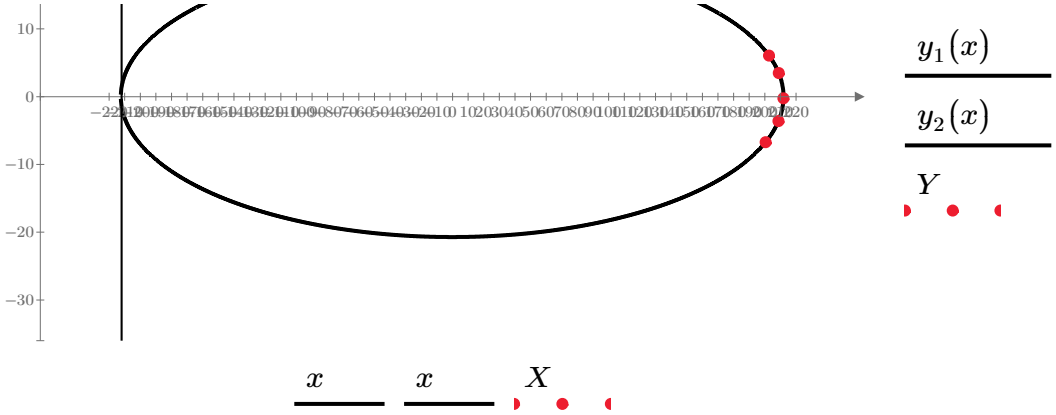
From Python

3.81628338e-03,
-3.08635404e-04,
7.31303610e-02,
-6.40121131e-01,
6.41401341e-02

$$y_1(x) := -\frac{a_y + \sqrt{a_y^2 + 2 \cdot a_y \cdot a_{xy} \cdot x + a_{xy}^2 \cdot x^2 - a_{x2} \cdot a_{y2} \cdot x^2 - 2 \cdot a_x \cdot a_{y2} \cdot x - a_{y2} \cdot a_0} + a_{xy} \cdot x}{a_{y2}}$$

$$y_2(x) := -\frac{a_y - \sqrt{a_y^2 + 2 \cdot a_y \cdot a_{xy} \cdot x + a_{xy}^2 \cdot x^2 - a_{x2} \cdot a_{y2} \cdot x^2 - 2 \cdot a_x \cdot a_{y2} \cdot x - a_{y2} \cdot a_0} + a_{xy} \cdot x}{a_{y2}}$$

$$x := -240, -240 + \frac{480}{10000} .. 240 \qquad \alpha := 0, \frac{2\pi}{360} .. 2\pi$$



$y_1(x)$

$y_2(x)$

Y

x x X

$Sun := 1$ $Comet\_1811\_trajectory := 1$ $Measuring\_points := 1$ $Astronomical\_Unit := 1$

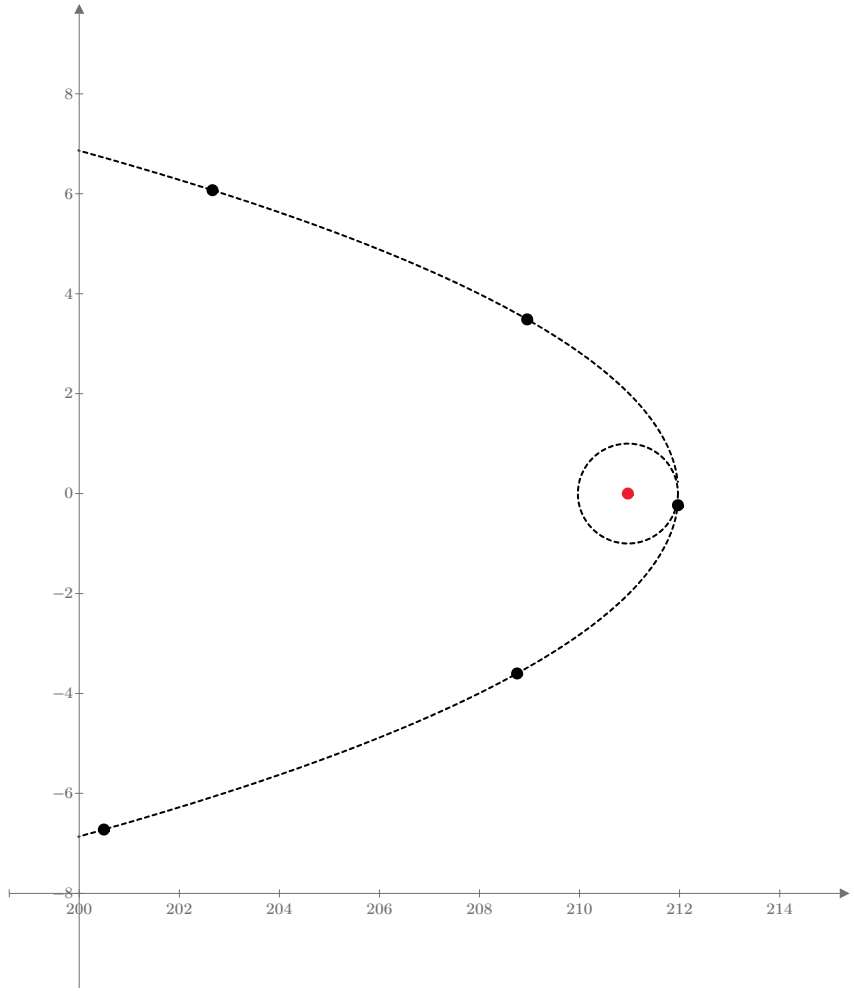
$y_1(x)$ $(Comet\_1811\_trajectory)$

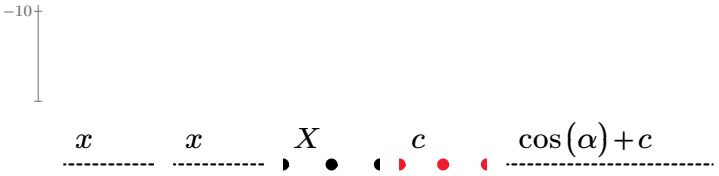
$y_2(x)$ $(Comet\_1811\_trajectory)$

Y $(Measuring\_points)$

0 (Sun)

$\sin(\alpha)$ $(Astronomical\_Unit)$




−10
x
x
X
c
cos(α)+c