Assignment-7

Problem Statement:

Find the maximum rectangle inscribable in a given ellipse,i.e,find the maximum value of xy,having given $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
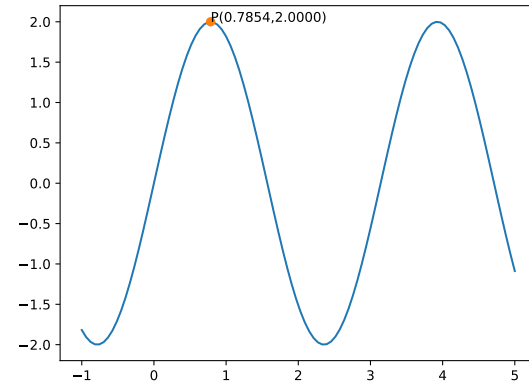
Solution

Gradient Ascent

$$f(x) = 2ab\sin(2x) \qquad (1)$$
$$f'(x) = 2ab\cos(2x) \qquad (2)$$

we have to attain the maximum value of area of rectangle. This can be seen in Figure.Using gradient ascent method we can find its maxima.

$$x_{n+1} = x_n + \alpha \nabla f(x_n) \qquad (3)$$

$$\implies x_{n+1} = x_n + \alpha(2ab\cos(2x))) \qquad (4)$$

Taking $x_0 = 0.5, \alpha = 0.001$ and precision $= 0.00000001$, values obtained using python are:

$$\boxed{\text{Maxima} = 1.9999} \qquad (5)$$

$$\boxed{\text{Maxima Point} = 0.7853} \qquad (6)$$

Download the code
Github link: Assignment 7.