

# Assignment No.6

Mr.Ganesh Yadav

Download all python codes from

svn co <https://github.com/Ganeshyadav712/Assignment-7.git>

Question taken from

[https://github.com/gadepall/ncert/blob/main/linalg/optimization/gvv\\_ncert\\_opt.pdf](https://github.com/gadepall/ncert/blob/main/linalg/optimization/gvv_ncert_opt.pdf) question 2.7

from question

$$\therefore x + 2y + \pi \frac{x}{2} = 10 \quad (2.0.9)$$

$$x \frac{\pi}{2} + 1 + 2y = 0 \quad (2.0.10)$$

$$2y = 10 - x \frac{\pi + 2}{2} \quad (2.0.11)$$

$$y = 5 - \frac{x(\pi + 2)}{4} \quad (2.0.12)$$

for maximum or minimum value of A,

$$\frac{dA}{dX} = 0 \quad (2.0.13)$$

$$5 - \frac{\pi + 4}{8} \cdot 2X = 0 \quad (2.0.14)$$

$$X = \frac{20}{\pi + 4} \quad (2.0.15)$$

$$\left. \frac{d^2A}{dx^2} \right|_X = \frac{20}{\pi + 4} \quad (2.0.16)$$

## 1 QUESTION No 1

A window is in the form of a rectangle surmounted by a semi-circular opening. The total perimeter of the window is 10 metres. Find the dimensions of the rectangle so as to admit maximum light through the whole opening.

## 2 SOLUTION

Let x and y be the length and width of rectangle part of window respectively.

Let A be the opening area of the window which admits Light. Obviously, for admitting the maximum light through the opening, A must be maximum.

Now

A = Area of rectangle + Area of the semi-circle.

$$A = xy + \frac{1}{2}\pi \cdot \frac{x^2}{4} \quad (2.0.1)$$

$$A = xy + \frac{\pi \cdot x^2}{8} \quad (2.0.2)$$

$$A = x \frac{5 - x(\pi + 2)}{4} + \frac{\pi \cdot x^2}{8} \quad (2.0.3)$$

$$A = 5x - \frac{(\pi + 2)x^2}{4} + \frac{\pi \cdot x^2}{8} \quad (2.0.4)$$

$$A = 5x - \frac{(\pi + 2)}{4}x^2 - \frac{\pi}{8}x^2 \quad (2.0.5)$$

$$A = 5x - \frac{(\pi + 4)}{8}x^2 \quad (2.0.6)$$

$$\frac{dA}{dX} = 5 - \frac{\pi + 4}{8}2X \quad (2.0.7)$$

$$(2.0.8)$$

for  $X = \frac{20}{\pi + 4}$ , A is maximum and hence

$$Y = 5 - \frac{20}{\pi + 4} \cdot \frac{\pi + 2}{4} \quad (2.0.17)$$

$$5 - \frac{5(\pi + 2)}{\pi + 4} \quad (2.0.18)$$

$$\frac{5\pi + 20 - 5\pi - 10}{\pi + 4} \quad (2.0.19)$$

$$\frac{10}{\pi + 4} \quad (2.0.20)$$

$\therefore$  for maximum A for admitting the maximum light

length of rectangle =  $X = \frac{20}{\pi + 4}$

breadth of rectangle =  $Y = \frac{10}{\pi + 4}$