6.5.5.1

EE24BTECH11012 - Bhavanisankar G S

QUESTION :
Find the absolute maximum and minimum value of the function $f(x) = x^3$ in the interval $[-2, 2]$
SOLUTION :

Theoritical solution :
Given function,

$$y(x) = x^3 \tag{0.1}$$
$$\implies y'(x) = 3x^2 \tag{0.2}$$
$$\implies y''(x) = 6x \tag{0.3}$$

To find the critical points, we do

$$y'(x) = 0 \tag{0.4}$$
$$3x^2 = 0 \tag{0.5}$$
$$x = 0 \tag{0.6}$$

For

$$Localmin \implies y''(x) > 0 \tag{0.7}$$
$$Localmax \implies y''(x) < 0 \tag{0.8}$$
$$Inflectionpoint \implies y''(x) = 0 \tag{0.9}$$

Substituting (0.6) in (0.3), we have

$$y'' = 0 \tag{0.10}$$

Hence, (0.6) is a critical point.
Checking the edge values, we have

$$y(2) = 8 \tag{0.11}$$
$$y(-2) = -8 \tag{0.12}$$
$$y(0) = 0 \tag{0.13}$$

Hence,
Absolute maximum = 8
Absolute minimum = -8

Computational solution :

Finding maximum value of a function can be done using **Gradient Ascent method**

$$x_{n+1} = x_n + \alpha f'(x_n) \tag{0.14}$$
$$x_{n+1} = x_n + 3\alpha x_n^2 \tag{0.15}$$

Similarly, the minimum value can be found out using **Gradient descent** method.

$$x_{n+1} = x_n - \alpha f'(x_n) \tag{0.16}$$
$$x_{n+1} = x_n - 3\alpha x_n^2 \tag{0.17}$$

where α is the learning rate. Taking

$$h = 0.01 \tag{0.18}$$
$$\alpha = 0.01 \tag{0.19}$$

we have

$$x_{min} = -2 \tag{0.20}$$
$$y_{min} = -8 \tag{0.21}$$
$$x_{max} = 2 \tag{0.22}$$
$$y_{max} = 8 \tag{0.23}$$

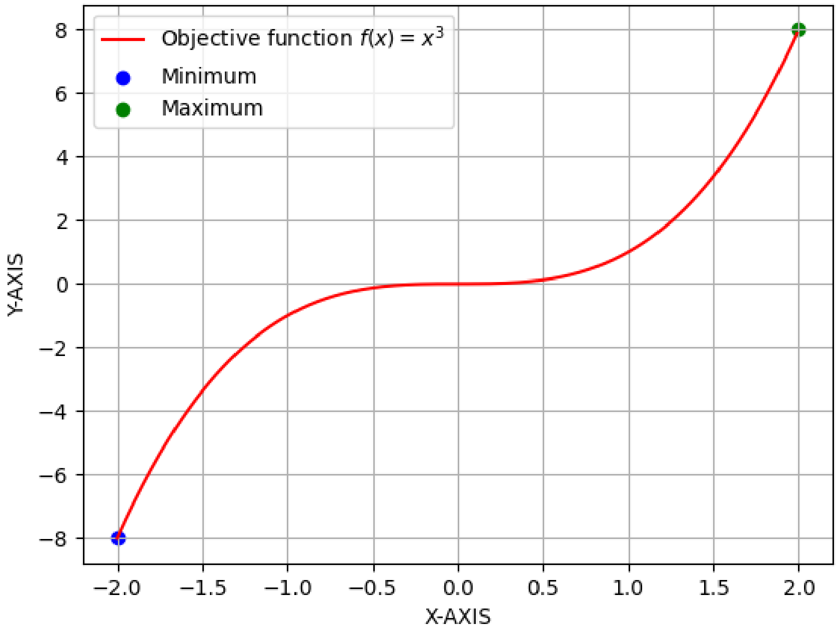

Fig. 0.1: Plot of the given question.