OMEGA ACADEMY, NUMERICAL METHODS COURSE.

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Numerical Methods

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Guide numerical methods.
Multimedia Engineering and Systems Engineering

UNIT TEN

Integral using the method of the rectangular rule

This method allow us to find the area under the curve of a function given by a graph , bounded by a known interval, by rectangles of the same size drawn from right to left or left to right, depending on the case and thus solve the integral and approximate the value found.

Example:

$$y = x^2$$

Given the interval [0, 1]

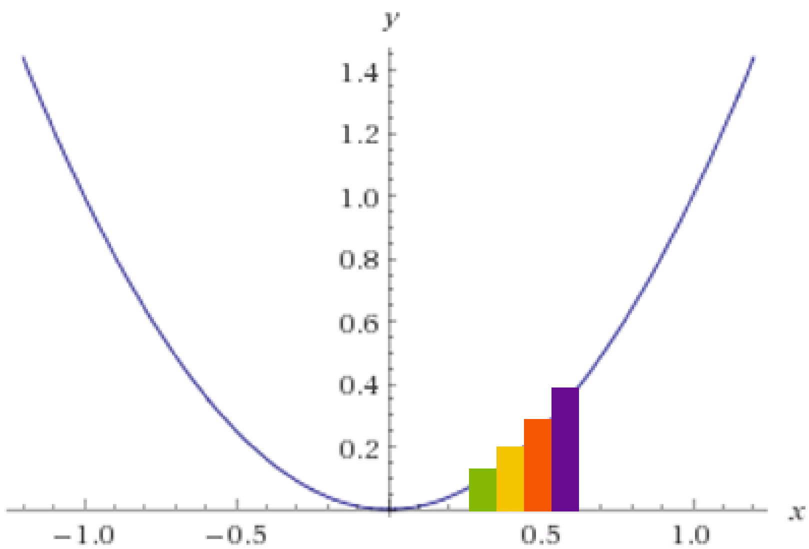

image 1: Graph from four rectangles

The width of the rectangle is given by $\frac{1}{n}$

While the height of the rectangles is determined by the function which is given $f(x) = x^2$

The width of the rectangles is

$$R1 = \frac{1}{4}, R2 = \frac{1}{2}, R3 = \frac{3}{4}, R4 = 1$$

Starting from 0 to 1 as indicated by the interval.

The formula used to find the area under the curve approximated by the four initially plotted rectangles is as follows:

$$s_4 = \frac{1}{n^3}\frac{n(n+1)(2n+1)}{6}$$

Where n is the number of plotted rectangles, is this case n is equal to 4.

n = 4

Now, the value is replaced in the formula, but first simplifies the values obtaining the following result

$$s_4 = \frac{(n+1)(2n+1)}{6n^2}$$

$$s_4 = \frac{(4+1)(2(4)+1)}{6(4)^2}$$

$$s_4 = \frac{5(9)}{6(16)}$$

$$s_4 = 0.468$$

0.468 is the approximate area under the curve, the more rectangles the more accurate the values is.

Now the integral defined by the middle point method is performed.

$$\int_a^b f(x)dx$$

Replacing,

$$\int_0^1 x^2\,dx$$

$$\left[\frac{x^3}{3}\right]_0^1$$

$$\frac{1^3}{3} - \frac{0^3}{3} = \frac{1}{3}$$

Now, the integral value is multiplied by the sum of all widths of the rectangles.

$$\frac{1}{4} + \frac{1}{2} + \frac{3}{4} + 1$$

$$\frac{1}{3} * \left(\frac{1}{4} + \frac{1}{2} + \frac{3}{4} + 1\right)$$

Resulting in

$$\frac{5}{6}$$