Lab Record: Approximate area under a parabola using trapezoidal rule.

Aim

The aim of this experiment is to approximate the area under the parabola defined by the function f(x) = x^2 between x = 0 and x = 5 using the trapezoidal rule. This involves dividing the area into trapezoids and summing their areas to estimate the total area.

Theory

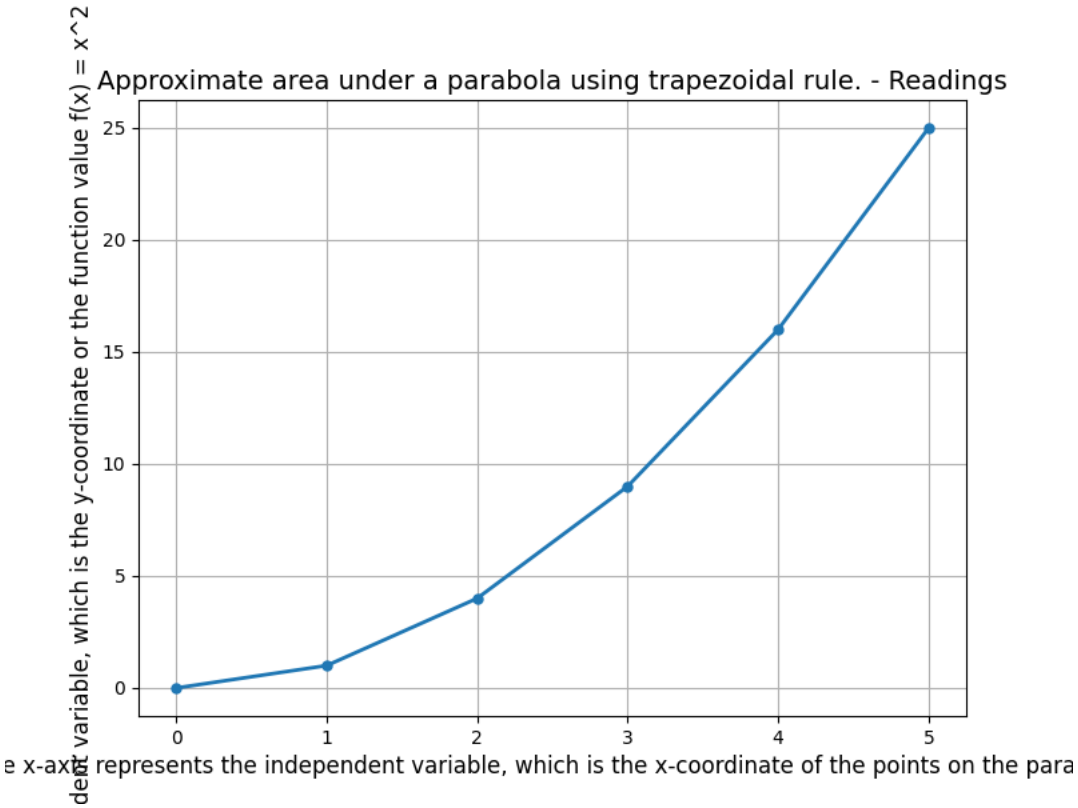
The trapezoidal rule is a numerical integration technique used to approximate the definite integral of a function. It works by dividing the area under the curve into a series of trapezoids and summing their areas. The area of each trapezoid is calculated as h * (f(x_i) + f(x_{i+1})) / 2, where h is the width of the trapezoid (the difference between consecutive x-values), and f(x_i) and f(x_{i+1}) are the function values at the left and right edges of the trapezoid, respectively. By summing the areas of all the trapezoids, we obtain an approximation of the definite integral, which represents the area under the curve. The accuracy of the trapezoidal rule increases as the number of trapezoids increases (i.e., as the width h decreases). This method provides a reasonable approximation when an analytical solution to the integral is difficult or impossible to obtain. In this experiment, we apply the trapezoidal rule to approximate the area under the parabola f(x) = x^2.

Procedure

1. Record the given data points (x, y) representing points on the parabola f(x) = x^2: (0.0, 0.0); (1.0, 1.0); (2.0, 4.0); (3.0, 9.0); (4.0, 16.0); (5.0, 25.0). 2. Calculate the width (h) of each trapezoid. Since the x-values are evenly spaced, h is constant and equal to 1.0. 3. Calculate the area of each trapezoid using the formula: Area = h * (f(x_i) + f(x_{i+1})) / 2, where f(x_i) is the y-value at x_i. 4. Sum the areas of all the trapezoids to obtain the approximate area under the parabola. 5. Record the calculated approximate area.

Result

The approximate area under the parabola f(x) = x^2 from x = 0 to x = 5, calculated using the trapezoidal rule with the given data points, is 41.0. This value represents an estimation of the definite integral of x^2 within the specified bounds.


Approximate area under a parabola using trapezoidal rule. - Readings
dent variable, which is the y-coordinate or the function value f(x) = x^2
0
5
10
15
20
25
0
1
2
3
4
5
e x-axis represents the independent variable, which is the x-coordinate of the points on the para