Trapezoidal Rule for Approximate Value of Definite Integral

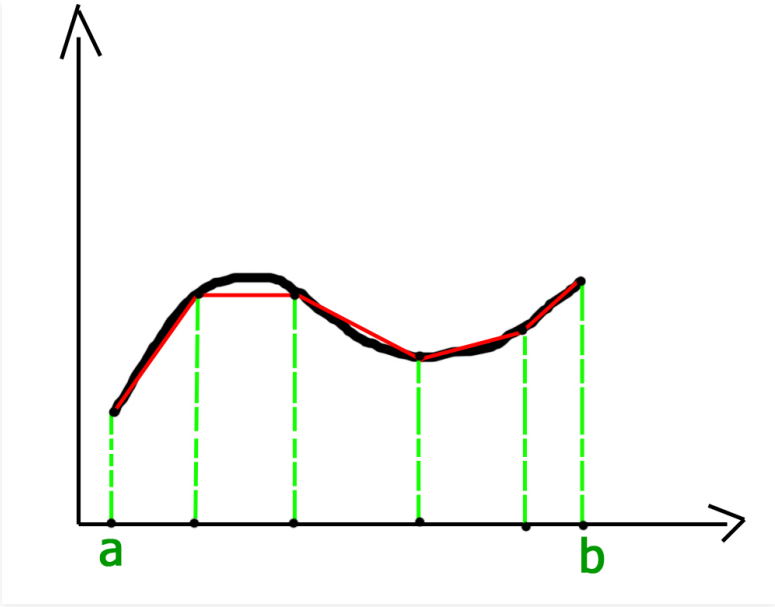
Difficulty Level : Easy • Last Updated : 17 Jun, 2021

In the field of numerical analysis, Trapezoidal rule is used to find the approximation of a definite integral. The basic idea in Trapezoidal rule is to assume the region under the graph of the given function to be a trapezoid and calculate its area.

It follows that:

$$\int_a^b f(x)\,dx \approx (b-a)\left[\frac{f(a)+f(b)}{2}\right]$$

For more accurate results the domain of the graph is divided into n segments of equal size as shown below:



Grid spacing or segment size h = (b-a) / n.

Therefore, approximate value of the integral can be given by:

$$\int_a^b f(x)dx = \frac{b-a}{2n}\left[f(a) + 2\left\{\sum_{i=1}^{n-1} f(a+ih)\right\} + f(b)\right]$$

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```
// C++ program to implement Trapezoidal rule
```

```c
#include<stdio.h>

// A sample function whose definite integral's
// approximate value is computed using Trapezoidal
// rule
float y(float x)
{
    // Declaring the function f(x) = 1/(1+x*x)
    return 1/(1+x*x);
}

// Function to evaluate the value of integral
float trapezoidal(float a, float b, float n)
{
    // Grid spacing
    float h = (b-a)/n;

    // Computing sum of first and last terms
    // in above formula
    float s = y(a)+y(b);

    // Adding middle terms in above formula
    for (int i = 1; i < n; i++)
        s += 2*y(a+i*h);

    // h/2 indicates (b-a)/2n. Multiplying h/2
    // with s.
    return (h/2)*s;
}

// Driver program to test above function
int main()
{
    // Range of definite integral
    float x0 = 0;
```

```
        float xn = 1;

        // Number of grids. Higher value means
        // more accuracy
        int n = 6;

        printf("Value of integral is %6.4f\n",
                        trapezoidal(x0, xn, n));
        return 0;
    }
```

Output:

```
Value of integral is 0.7842
```

References:

https://en.wikipedia.org/wiki/Trapezoidal_rule

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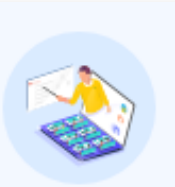

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