**Trapezoidal Method**

The value of = 0.318310989

Area under the curve using the Trapezoidal Method of integration

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **h** | **h/2** | **h/4** | **h/8** | **h/16** | **h/32** | **h/64** |
|  | **n = 1** | **n = 2** | **n = 4** | **n = 8** | **n = 16** | **n = 32** | **n = 64** |
| **Area** | 0.25 | 0.3017767 | 0.3142087 | 0.3172866 | 0.3180542 | 0.3182459 | 0.3182939 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **h/128** | **h/256** | **h/512** |  |  |  |  |
|  | **n = 128** | **n = 256** | **n = 512** |  |  |  |  |
| **Area** | 0.3183059 | 0.3183089 | 0.3183096 |  |  |  |  |

Using the trapezoidal method of integration :

The real value of = 0.318310989 in order for us to use the Trapezoidal Method of integration to get to the seventh decimal place accuracy we had to divide the graph into ten pieces to come close to the result. The area calculated using n = 512 is 0.3183096 compared to the real result which was 0.318310989. The calculated difference is 1.389.

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The value of = 0.71636279

Area under the curve using the Trapezoidal Method of integration

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **h** | **h/2** | **h/4** | **h/8** | **h/16** | **h/32** | **h/64** |
|  | **n = 1** | **n = 2** | **n = 4** | **n = 8** | **n = 16** | **n = 32** | **n = 64** |
| **Area** | 0.7633741 | 0.7250621 | 0.7184033 | 0.7168651 | 0.7164879 | 0.7163940 | 0.7163706 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **h/128** | **h/256** | **h/512** |  |  |  |  |
|  | **n = 128** | **n = 256** | **n = 512** |  |  |  |  |
| **Area** | 0.7163647 | 0.7163632 | 0.7163629 |  |  |  |  |

For this equation it only took n = 256 , where n is the number of trapezoids used to get to a seven decimal place accuracy. The difference between the real value of the integral and n = 256 is

0.71636279 - 0.7163632 = -4.

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= = 1.22570483

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **h** | **h/2** | **h/4** | **h/8** | **h/16** | **h/32** | **h/64** |
|  | **n = 1** | **n = 2** | **n = 4** | **n = 8** | **n = 16** | **n = 32** | **n = 64** |
| **Area** | 0.5 | -0.166666 | 0.01111111 | -0.000176 | 6.9163468 | -6.760847 | 1.6510005 |

**Romberg Method**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| level | 0 | 1 | 2 | 3 | 4 |
| 1 | 0.318309886 | 0.318309886 | 0.318309886 | 0.318309886 | 0.318309886 |
| 2 | 0.318309886 | 0.318309886 | 0.318309886 | 0.318309886 |  |
| 4 | 0.318309886 | 0.318309886 | 0.318309886 |  |  |
| 8 | 0.318309886 | 0.318309886 |  |  |  |
| 16 | 0.318309886 |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| level | 0 | 1 | 2 | 3 | 4 |
| 1 | 0.71636279 | 0.71636279 | 0.71636279 | 0.716362794 | 0.716362794 |
| 2 | 0.716362794 | 0.716362794 | 0.716362794 | 0.716362794 |  |
| 4 | 0.716362794 | 0.716362794 | 0.716362794 |  |  |
| 8 | 0.716362794 | 0.716362794 |  |  |  |
| 16 | 0.71636279 |  |  |  |  |