11. Trapezoidal Integration

In[1]:=

In[2]:=

Q1. Solve : 1/(1+x)

In[ ]:=

In[24]:=
```
ClearAll
a = Input["Enter the left end limit : "]
b = Input["Enter the right end limit : "]
n = Input["Enter the number of sub intervals : "]
sum = 0;
h = (b - a) / n;
f[x] = 1 / (1 + x)
For[i = 1, i ≤ n - 1, i++, sum += N[f[x] /. x → (a + i * h)]]
sum = N[(2 * sum + (f[x] /. x → a) + (f[x] /. x → b)) * h / 2]
in = Integrate[1 / (1 + x), {x, 0, 1}]
Print["The value is : ", in]
Print["Absolute Error : ", Abs[sum - in]]
```

Out[24]= ClearAll

Out[25]= 0

Out[26]= 1

Out[27]= 8

Out[30]= $\frac{1}{1+x}$

Out[32]= 0.694122

Out[33]= Log[2]

```
The value is : Log[2]

Absolute Error : 0.00097467
```

Q2. Solve the equation : 1/(x^3+x^2+x)

In[36]:=
```
ClearAll
a = Input["Enter the left end limit : "]
b = Input["Enter the right end limit : "]
n = Input["Enter the number of sub intervals : "]
sum = 0;
h = (b - a) / n;
f[x] = 1 / (x^3 + x^2 + x)
For[i = 1, i ≤ n - 1, i++, sum += N[f[x] /. x → (a + i * h)]]
sum = N[(2 * sum + (f[x] /. x → a) + (f[x] /. x → b)) * h / 2]
in = Integrate[1 / (x^3 + x^2 + x), {x, 4, 5}]
Print["The value is : ", in]
Print["Absolute Error : ", Abs[sum - in]]
```

Out[36]= ClearAll

Out[37]= 4

Out[38]= 5

Out[39]= 10

Out[42]= $\frac{1}{x + x^2 + x^3}$

Out[44]= 0.00881461

Out[45]= $-\frac{\text{ArcTan}\left[\frac{11}{\sqrt{3}}\right]}{\sqrt{3}} + \frac{\text{ArcTan}\left[3\sqrt{3}\right]}{\sqrt{3}} + \frac{1}{2}\text{Log}\left[\frac{525}{496}\right]$

The value is : $-\frac{\text{ArcTan}\left[\frac{11}{\sqrt{3}}\right]}{\sqrt{3}} + \frac{\text{ArcTan}\left[3\sqrt{3}\right]}{\sqrt{3}} + \frac{1}{2}\text{Log}\left[\frac{525}{496}\right]$

Absolute Error : 3.74806×10^{-6}

Q3. Solve : $\sqrt{x\text{^}2 + (1/x\text{^}4)}$

In[48]:=
```
ClearAll
a = Input["Enter the left end limit : "]
b = Input["Enter the right end limit : "]
n = Input["Enter the number of sub intervals : "]
sum = 0;
h = (b - a) / n;
f[x] = Sqrt[x^2 + (1 / x^4)]
For[i = 1, i ≤ n - 1, i++, sum += N[f[x] /. x → (a + i * h)]]
sum = N[(2 * sum + (f[x] /. x → a) + (f[x] /. x → b)) * h / 2]
in = Integrate[Sqrt[x^2 + (1 / x^4)], {x, 2, 15}]
Print["The value is : ", in]
Print["Absolute Error : ", Abs[sum - in]]
```

Out[48]= ClearAll

Out[49]= 2

Out[50]= 15

Out[51]= 30

Out[54]= $\sqrt{\frac{1}{x^4} + x^2}$

Out[56]= 110.508

Out[57]= $-\frac{11\,390\,626}{15}\sqrt{11\,390\,626}\ \text{Hypergeometric2F1}\left[1, \frac{4}{3}, \frac{5}{6}, -11\,390\,625\right] + \frac{65}{2}\sqrt{65}\ \text{Hypergeometric2F1}\left[1, \frac{4}{3}, \frac{5}{6}, -64\right]$

```
The value is : -(11390626/15) Sqrt[11390626] Hypergeometric2F1[1, 4/3, 5/6, -11390625] +
  (65/2) Sqrt[65] Hypergeometric2F1[1, 4/3, 5/6, -64]
Absolute Error : 0.000587928
```

Q4. Solve : $\sqrt{x\text{^}3}$ +x^2

In[72]:=

```
ClearAll
a = Input["Enter the left end limit : "]
b = Input["Enter the right end limit : "]
n = Input["Enter the number of sub intervals : "]
sum = 0;
h = (b - a) / n;
f[x] = √x^3 + x^2
For[i = 1, i ≤ n - 1, i++, sum += N[f[x] /. x → (a + i * h)]]
sum = N[(2 * sum + (f[x] /. x → a) + (f[x] /. x → b)) * h / 2]
in = Integrate[√x^3 + x^2, {x, 2, 5}]
Print["The value is : ", in]
Print["Absolute Error : ", Abs[sum - in]]
```

Out[72]= ClearAll

Out[73]= 2

Out[74]= 5

Out[75]= 20

Out[78]= $x^2 + \sqrt{x^3}$

Out[80]= 59.1115

Out[81]= $39 - \frac{8\sqrt{2}}{5} + 10\sqrt{5}$

The value is : $39 - \frac{8\sqrt{2}}{5} + 10\sqrt{5}$

Absolute Error : 0.0135614