Simpson 1/3 Rule

Q1 ∫1/5+3x dx from 0 to 1

In[227]:=
```
f[x_] = 1 / (5 + 3 x);
a = 0;
b = 1;
n = 6;
h = (b - a) / n;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = N[Integrate[1 / (5 + 3 x), {x, 0, 1}]];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 0.156668

Approximate value of Integral is: 0.156669

Error in Integral is: 9.17754 × 10^-7
```

Q2 ∫1/x^2 dx from 1 to 5

In[237]:=
```
f[x_] = 1 / x ^ 2;
a = 1;
b = 5;
n = 10;
h = (b - a) / n;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = Integrate[1 / x ^ 2, {x, 1, 5}];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 4/5

Approximate value of Integral is: 0.802304

Error in Integral is: 0.0023043
```

Q3 ∫e^-x^2 from 0 to0. 6

In[247]:=
```
f[x_] = Exp[-x^2];
a = 0;
b = .6;
n = 10;
h = (b - a) / n;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = Integrate[Exp[-x^2], {x, 0, .6}];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 0.535154

Approximate value of Integral is: 0.535154

Error in Integral is: 2.75736 × 10^-7
```

Q ∫1/1+x^2 from 0 to 0.6 and h=0.1

In[257]:=
```
f[x_] = 1 / (1 + x^2);
a = 0;
b = 0.6;
h = 0.1;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = N[Integrate[1 / (1 + x^2), {x, 0, 0.6}]];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 0.54042

Approximate value of Integral is: 0.540421

Error in Integral is: 1.49246 × 10^-6
```

Q4 ∫x^2/1+x^3 dx from 0 to 1 and h=0.25

In[266]:=
```
f[x_] = x^2 / (1 + x^3);
a = 0;
b = 1;
h = 0.25;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = N[Integrate[x^2 / (1 + x^3), {x, 0, 1}]];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 0.231049

Approximate value of Integral is: 0.231085

Error in Integral is: 0.0000355959
```

Q4 $\int \sin x \, dx$ from 0 to π

In[295]:=
```
f[x_] = Sin[x];
a = 0;
b = Pi;
n = 8;
h = (b - a) / n;
sol =
  (h / 3) * (f[a] + 4 * Sum[f[i], {i, a + h, b - h, 2 * h}] + 2 * Sum[f[i], {i, a + 2 h, b - 2 h, 2 * h}] + f[b]);
in = Integrate[Sin[x], {x, 0, Pi}];
Print["Exact Value of Integral is: ", in]
Print["Approximate value of Integral is: ", N[sol]]
Print["Error in Integral is: ", Abs[in - N[sol]]]
```

```
Exact Value of Integral is: 2

Approximate value of Integral is: 2.00027

Error in Integral is: 0.00026917
```