

Simpson's One-Third Rule:

$$I[f] = \int_a^b \frac{1}{1+x^2} dx = \frac{h}{3} [f_0 + 4f_1 + 2f_2 + 4f_3 + 2f_4 + \dots + 4f_{n-1} + f_n]$$

Example :

Evaluate the following integral using Simpson's One-Third Rule.

$$\int_0^1 \frac{1}{1+x^2} dx \quad \text{taking } h=0.25.$$

```
% Simpson One-Third Rule
function s=simpr1(f,a,b,n)
format long g
n=input('n=');
a=input('a=');
b=input('b=');
h=(b-a)/n;
s1=0;
s2=0;
for i=1:2:n-1
x=a+h*i;
s1=s1+feval('f',x);
end
for i=2:2:n-2
x=a+h*i;
s2=s2+feval('f',x);
end
s=h*(feval('f',a)+feval('f',b)+(4*s1)+(2*s2))/3;

function g=f(x)
g=1/(1+x^2);

% n=4 , a=0, b=1 result= 0.785392156862745
```

Simpson's Three-Eighth Rule:

$$I = \frac{3}{8}h[f_0 + 3\sum_{i=0}^{\frac{n}{3}-1} f(x_{3i+1}) + 3\sum_{i=0}^{\frac{n}{3}-1} f(x_{3i+2}) + 2\sum_{i=1}^{\frac{n}{3}-1} f(x_{3i}) + f_n]$$

Example : Use Simpson's Three-Eighth Rule to evaluate the integral, taking $h=1/6$.

$$\int_0^1 (x^3 + 1)dx$$

```
% 3/8 Simpson Method
function s=simpr3(f,a,b,h)
format long g
h=input('h=');
a=input('a=');
b=input('b=');
n=(b-a)/h;
s1=0;
s2=0;
s3=0;
for i=1:3:n-2
x=a+h*i;
s1=s1+feval('f',x);
end
for i=2:3:n-1
x=a+h*i;
s2=s2+feval('f',x);
end
for i=3:3:n-3
x=a+h*i;
s3=s3+feval('f',x);
end
s=(3*h/8)*(feval('f',a)+feval('f',b)+(3*s1)+(3*s2)+(2*s3));

function g=f(x)
g=1/(x^3+1);
% h=1/6 , a=0, b=1 result= 0.835711812828748
```