Practical 12

Simpson Rule

(1) Simpson's Rule

Q. Find $\int_2^3 \frac{1}{1+x}\,dx$ using Simpsons Rule.

```
Simpson[a0_, b0_, f_] := Module[{a = a0, b = b0, h, approxintegral},
   h = (b - a)/2; approxintegral = h/3 (f[a] + f[b] + 4 f[(a + b)/2]);
    Return[approxintegral];];
f[x_] := 1/(x + 1);
Simpson[2, 3, f]
```

$$\frac{145}{504}$$

```
N[%, 6]
```

```
0.287683
```

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(2) Composite Simpsons Rule

Q. Find $\int_0^1 \frac{1}{1+x}\,dx$ using Composite Simpsons Rule with number of intervals 2n = 2,4,8 and 16.

```
SimpsonRule[a0_, b0_, m_, f_] := Module[{a = a0, b = b0, h, ApproxIntegral, n},
   If[Mod[m, 2] ≠ 0, Print["m should be even positive integer"];
    Return[];];
   h = (b - a)/m;
   n = m/2;
   ApproxIntegral = h/3 (f[a] + f[b]) + 2 h/3 Sum[f[a + 2 k h], {k, 1, n - 1}] + 4 h/3 Sum[f[a + (2 k - 1) h], {k, 1, n}];
   Return[ApproxIntegral];];
f[x_] := 1/(x + 1);
N[SimpsonRule[0, 1, 2, f]]
```

```
0.694444
```

```
N[SimpsonRule[0, 1, 4, f]]
```

```
0.693254
```

```
N[SimpsonRule[0, 1, 8, f]]
```

```
0.693155
```

```
N[SimpsonRule[0, 1, 16, f]]
```

```
0.693148
```

$$\text{truevalue} = \int_0^1 \frac{1}{1+x}\, dx$$

```
Log[2]
```

```
N[%]
```

```
0.693147
```