

Tutorial I: Numerical Integration

Note: All Notations and symbols have their usual meaning.

1. Use Trapezoidal and Simpson's rules to find the approximate area under a given curve. A curve is given by the points of the table below.

x	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	23	19	14	11	12.5	16	19	20	20

Estimate the area bounded by the curve, the X -axis and the extreme ordinates.

2. Find the area using Trapezoidal and Simpson's rules bounded by the curve, the X -axis from $x = 7.47$ and $x = 7.52$.

x	7.47	7.48	7.49	7.50	7.51	7.52
y	1.93	1.95	1.98	2.01	2.03	2.06

3. For each of the following integrals use the given value of n to approximate the value of the integrals using Trapezoidal and Simpson's rules. Use at least six decimal places.

(a) $\int_1^5 \sqrt{1+x^2} dx$ using $n = 4$

(b) $\int_1^7 \frac{1}{x^3+1} dx$ using $n = 6$

(c) $\int_0^2 \frac{x}{x+1} dx$ using $n = 4$

(d) $\int_1^4 \sqrt{1+\frac{1}{x}} dx$ using $n = 3$

(e) $\int_{-1}^2 \sqrt{e^{-x^2}+1} dx$ using $n = 4$

4. Find the value of $\int_3^7 x^2 \log x dx$ by taking 4 stripes.
5. Use the Trapezoidal and Simpson's rules to estimate the value of $\int_5^{11} \frac{8}{x} dx$ using 3 strips of width 2.
6. Use the Trapezoidal and Simpson's rules to compute $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \frac{\cos x \ln(\sin x)}{\sin^2 x + 1} dx$.
7. Evaluate $\int_0^2 e^x dx$ using Trapezoidal and Simpson's rules with $h = 1$ and $h = 0.5$. Compare with the exact solution.
8. Find the approximate value of $I = \int_0^1 \frac{dx}{1+x}$ using Trapezoidal and Simpson's rules. The exact value of $I = \ln 2 = 0.693147$ correct to six decimal places. Compare with the exact solution.