

Numerical Integration

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NumInt(f, a, b, n) := | dx ← (b - a) / n
                    | s ← 0
                    | for i ∈ 1 .. n
                    |   | xi ← a + (i - 1) · dx
                    |   | xii ← a + i · dx
                    |   | Ai ← (f(xi) + f(xii)) / 2 · dx
                    |   | s ← s + Ai
                    | s
```

$$p(x) := 3 + 1.5 \cdot x - 0.25 \cdot x^2$$

$$\text{Area} := \int_0^5 p(x) dx$$

$$\text{Area} = 23.333$$

$$\text{NumInt}(p, 1, 5, 20) = 19.66$$

$$s(x) := \sin(x)$$

$$\text{NumInt}(s, 0, \pi, 50) = 1.999$$

$$A_S := \int_0^\pi s(x) dx$$

$$A_S = 2$$

Different Method:

$$g(x) := 3 + 1.5 \cdot x - 0.25 \cdot x^2$$

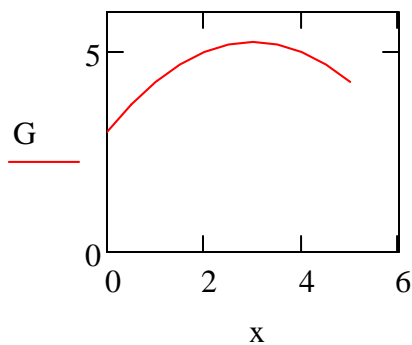
$$n := 10 \quad a := 0 \quad b := 5$$

$$i := 0..n \quad dx := \frac{b-a}{n} \quad dx = 0.5$$

$$x_i := i \cdot dx$$

$$G_i := g(x_i)$$

$$x = \begin{pmatrix} 0 \\ 0.5 \\ 1 \\ 1.5 \\ 2 \\ 2.5 \\ 3 \\ 3.5 \\ 4 \\ 4.5 \\ 5 \end{pmatrix} \quad G = \begin{pmatrix} 3 \\ 3.688 \\ 4.25 \\ 4.688 \\ 5 \\ 5.188 \\ 5.25 \\ 5.188 \\ 5 \\ 4.688 \\ 4.25 \end{pmatrix}$$



$$j := 0..n-1$$

$$A_j := \frac{G_{j+1} + G_j}{2} \cdot dx$$

$$A = \begin{pmatrix} 1.672 \\ 1.984 \\ 2.234 \\ 2.422 \\ 2.547 \\ 2.609 \\ 2.609 \\ 2.547 \\ 2.422 \\ 2.234 \end{pmatrix} \quad \sum_{j=0}^{n-1} A_j = 23.281$$

$$\text{Area}(f, a, b, n) := \left| \begin{array}{l} dx \leftarrow \frac{b-a}{n} \\ \text{for } i \in 0..n \\ \quad \left| \begin{array}{l} x_i \leftarrow i \cdot dx \\ F_i \leftarrow f(x_i) \end{array} \right. \\ \text{for } i \in 0..n-1 \\ \quad A_i \leftarrow \frac{F_{i+1} + F_i}{2} \cdot dx \\ \\ A \leftarrow \sum_{i=0}^{n-1} A_i \\ A \end{array} \right.$$

$$\text{Area}(g, 0, 5, 10) = 23.281$$

Linear
Interpolation

$$\text{LinInt}(T, P, TT) := \left| \begin{array}{l} \text{for } i \in 1 \dots \text{last}(T) - 1 \\ \quad \text{IP} \leftarrow P_i + \frac{P_{i+1} - P_i}{T_{i+1} - T_i} \cdot (TT - T_i) \quad \text{if } T_i \leq TT < T_{i+1} \\ \text{IP} \end{array} \right.$$

$$\underline{T} := \begin{pmatrix} 100 \\ 150 \\ 200 \\ 250 \\ 300 \\ 400 \\ 500 \end{pmatrix} \quad \text{IE} := \begin{pmatrix} 2506 \\ 2582 \\ 2658 \\ 2733 \\ 2810 \\ 2967 \\ 3131 \end{pmatrix} \quad T_1 = 150$$

$$\text{LinInt}(T, \text{IE}, 450) = 3049$$