Trapezoidal rule:

$$\int_a^b f(x)\,dx \approx \frac{b-a}{2n}\Big(f(x_0) + 2f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-1}) + f(x_n)\Big)$$

where $x_i = a + \dfrac{i(b-a)}{n}$, $i = 0, 1, 2, \ldots, n$.

Example 1. Use the trapezoidal rule with $n = 3$ to approximate the integral $\displaystyle\int_{-1}^{2} \frac{2}{\sqrt{x^2+1}}\,dx$. Given that $\sqrt{5} \approx 2.236$ and $\sqrt{2} \approx 1.414$.

Simpson's rule:

$$\int_a^b f(x)\,dx \approx \frac{b-a}{3n}\Big(f(x_0)+4f(x_1)+2f(x_2)+4f(x_3)+\cdots+2f(x_{n-2})+4f(x_{n-1})+f(x_n)\Big)$$

where n is an even integer and $x_i = a + \dfrac{i(b-a)}{n}$, $i = 0, 1, 2, \ldots, n$.

Example 2. Use the Simpson's rule with $n = 4$ to approximate the integral $\displaystyle\int_{-2}^{2} \frac{dx}{x^2+1}$.