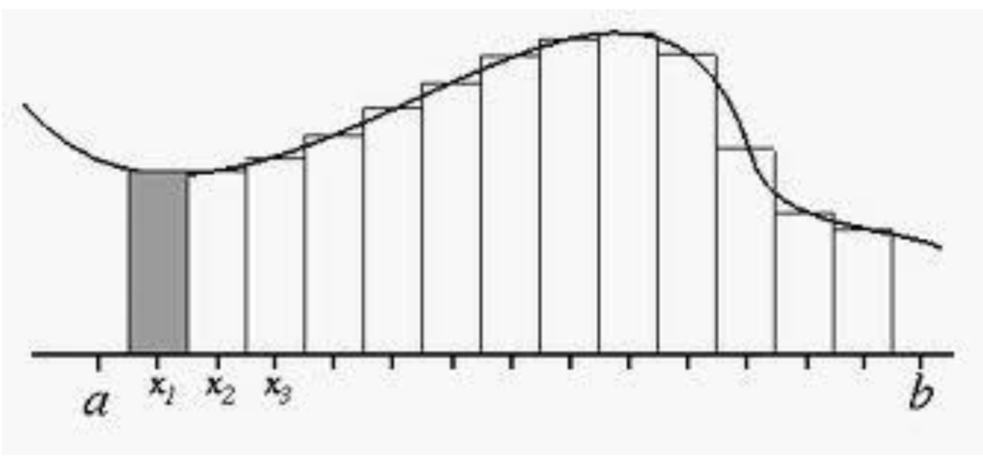
Parallel programming

MPI Interface

01 - π

The value of the definite integral $\int_0^1 \frac{4}{1+x^2}\,dx$ is π. We can use numerical integration to compute π by approximating the area under the curve $y = \frac{4}{1+x^2}$. A simple way to do this is called the rectangle rule (see below). We divide the interval $[0,1]$ into **k** subintervals of equal size. We find the height of the curve at the midpoint of each of these subintervals. Whith these hights we can construct **k** rectangles. The area of the rectangles approximates the area under the curve. As **k** increases, the accuracy of the estimate also increases.

Write a parallel program to compute π using the rectangle rule with 1,000,000 intervals.



02 - Simpson's rule

Simpson's rule is a better numerical integration algorithm then the rectangle rule because it converges more quickly. Suppose we want to compute $\int_a^b f(x)\,dx$. We divide the interval $[a, b]$ into **n** subintervals, where **n** is even. Let x_i denote the end of the *i*-th interval, for $1 \le i \le n$, and let x_0 denote the beginning of the first interval. According to Simpson's rule:

$$\int_a^b f(x)dx \approx \frac{1}{3n}\left[f(x_0) - f(x_n) + \sum_{i=1}^{n/2}\left(4f(x_{2i-1}) + 2f(x_{2i})\right)\right]$$

Write a parallel program to compute the value of π using Simpson's rule:

$f(x) = \frac{4}{1+x^2}$, $a = 0, b = 1$ and **n** = 1,000,000,000.