Lap 2 – Trapezoidal rule

A technique for approximating the definite integral.

Illustration of "chained trapezoidal rule" used on an irregularly-spaced partition of $[a, b]$.

Integral calculation:
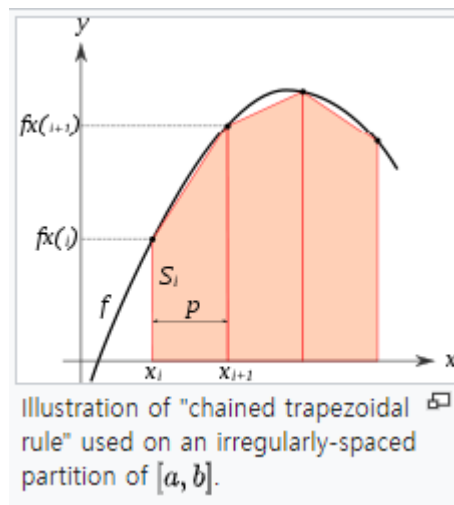
$$\int_a^b f(x)\,dx = \lim_{N \to \infty} \sum_{k=1}^{N} f(x_k)\Delta x, \ x_k = a + k\Delta x, \ \Delta x = \frac{b-a}{N}$$
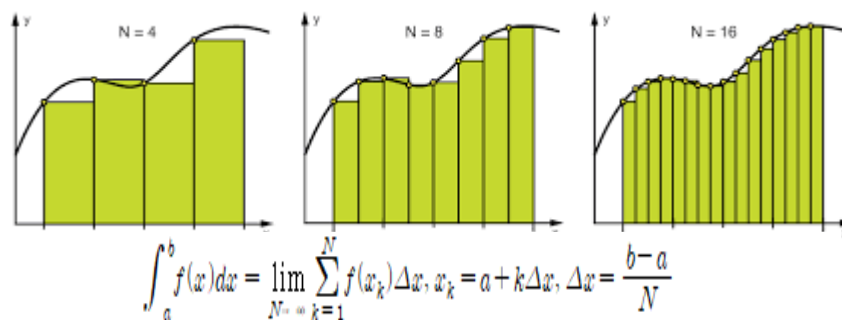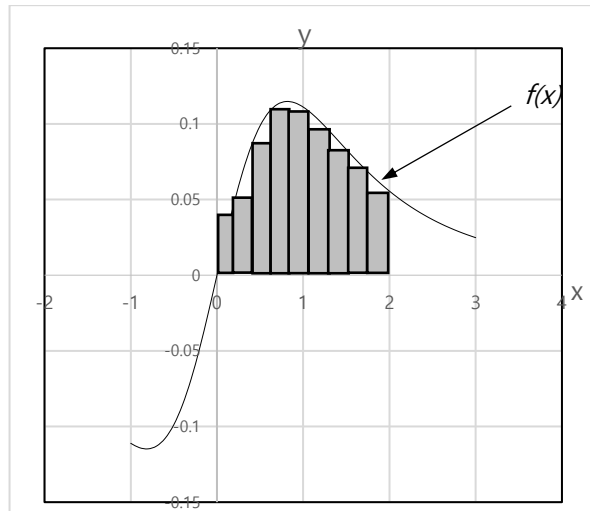
Program:
```
sum = 0.0;
dx = (b-a)/N;

x = a;
for (i=0; i<N; i++) {
    x += dx;
    sum += f(x) * dx;
}
```

(1) Write a C program(area.c) to calculate an area given by $f(x)=\dfrac{x}{(x^2+2)^3}$ where the range of x is from 0.0 to 2.0. (Use long and double for variables.)

Let z = x²+2 then dz = 2x dx

$$\therefore \int_0^2 \frac{x}{(x^2+2)^3}\,dx = \int_2^6 \frac{1}{2z^3}\,dz$$

$$=-\frac{1}{4}\left[\frac{1}{z^2}\right]_2^6 = -\frac{1}{4}\left(\frac{1}{36}-\frac{1}{4}\right) = \frac{1}{18} = 0.05555...$$

The number of segments(N) must be provided by the command line argument. For your test, use N < 1000000.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

main(int argc, char *argv[])
{
long N;

if (argc != 2) {
    printf("argument error\n");
    exit(1);
}
N = atol(argv[1]);
```

(2) Submit your program when you are done - **submit area.c** .