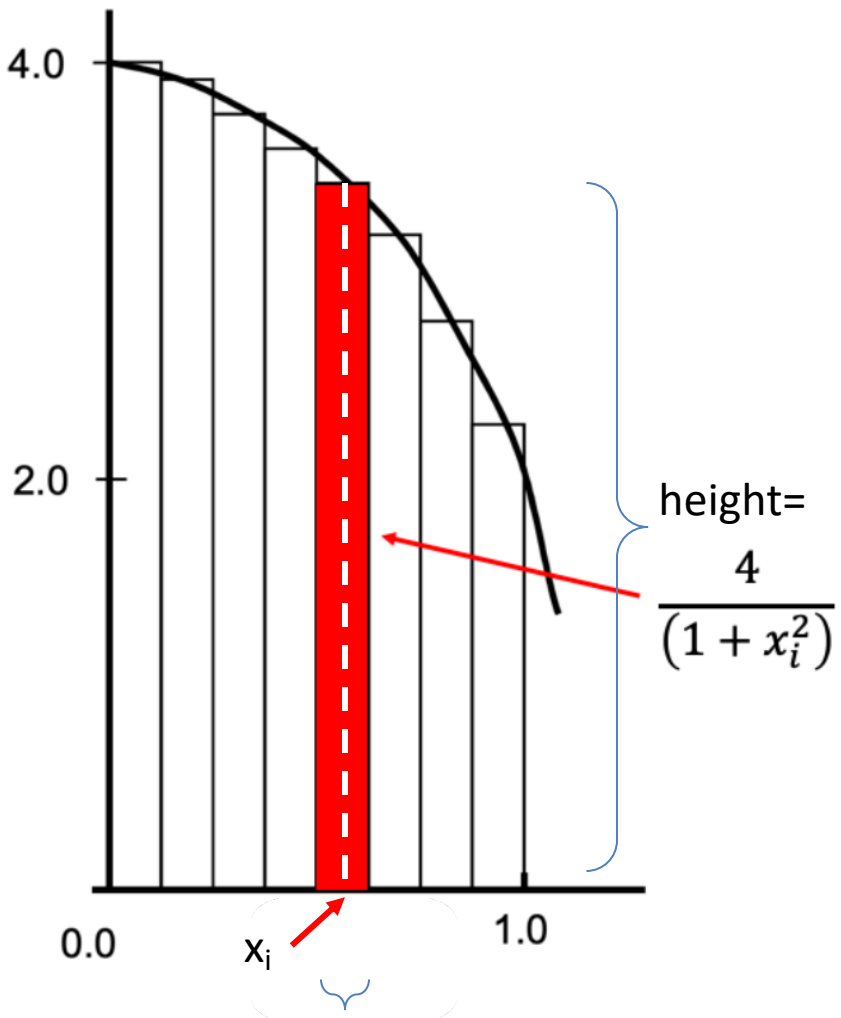
Project MPI

$$y = \frac{4}{(1 + x^2)}$$



Project MPI

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

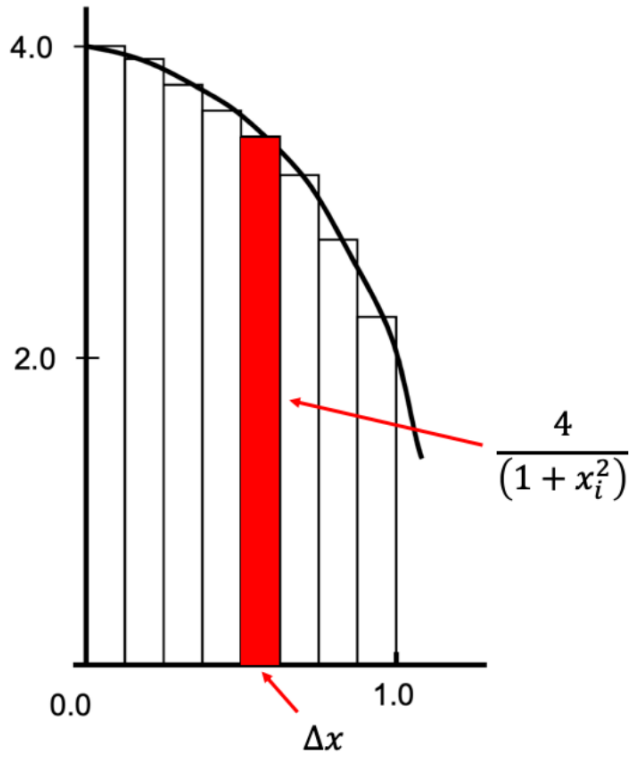
```
#define NUMSTEPS 1000000

int main() {
        int i;
        double x, pi, sum = 0.0;
        struct timespec start, end;

        clock_gettime(CLOCK_MONOTONIC, &start);
        double step = 1.0/(double) NUMSTEPS;
        x = 0.5 * step;

        for (i=0;i<= NUMSTEPS; i++){
                x+=step;
                sum += 4.0/(1.0+x*x);
        }
        pi = step * sum;
        clock_gettime(CLOCK_MONOTONIC, &end);
        u_int64_t diff = 1000000000L * (end.tv_sec - start.tv_sec) + end.tv_nsec -
start.tv_nsec;

        printf("PI is %.20f\n",pi);
        printf("elapsed time = %llu nanoseconds\n", (long long unsigned int) diff);

        return 0;
}
```

Δx

y

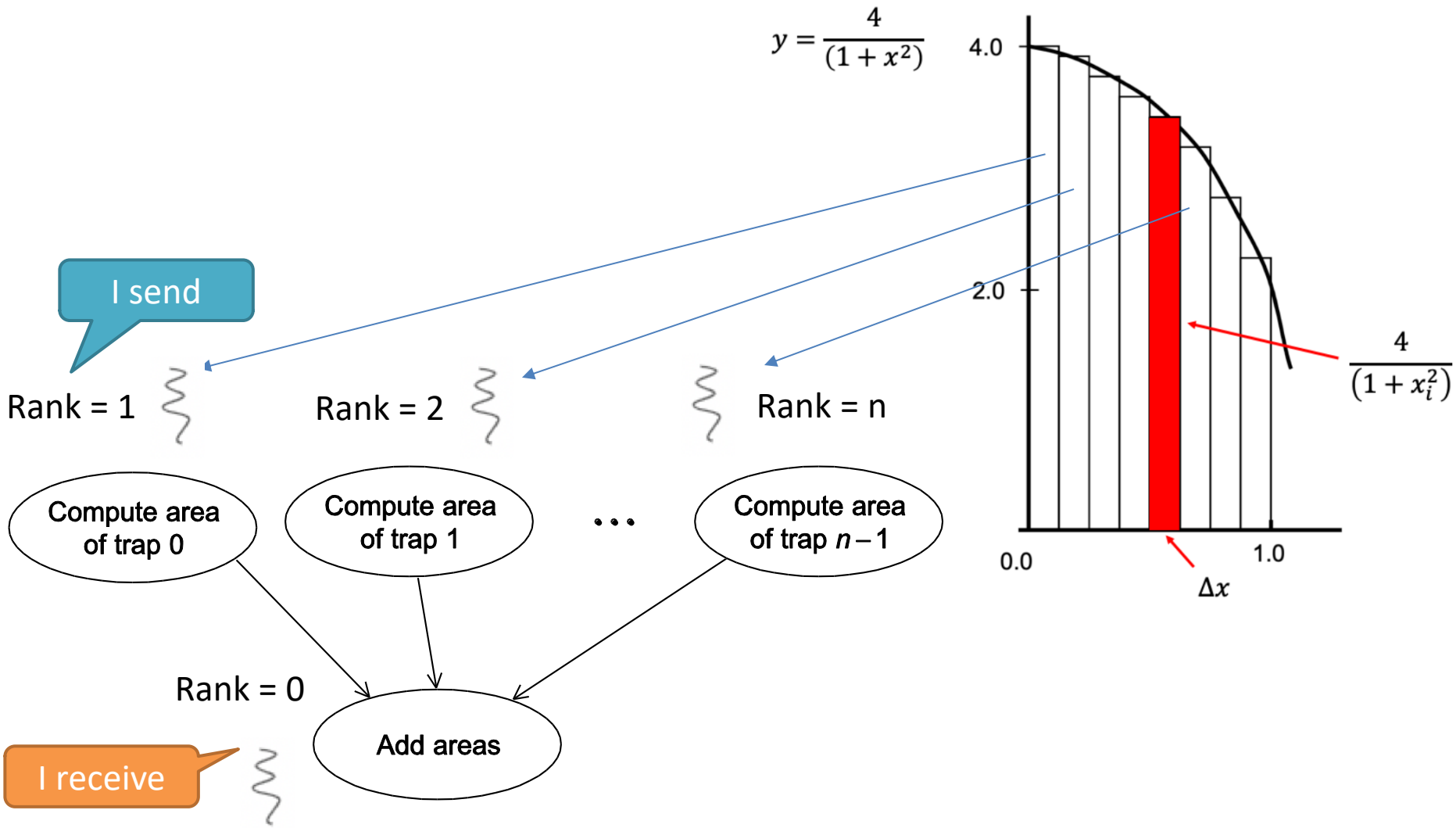
size of rectangle

$$y = \frac{4}{(1+x^2)}$$



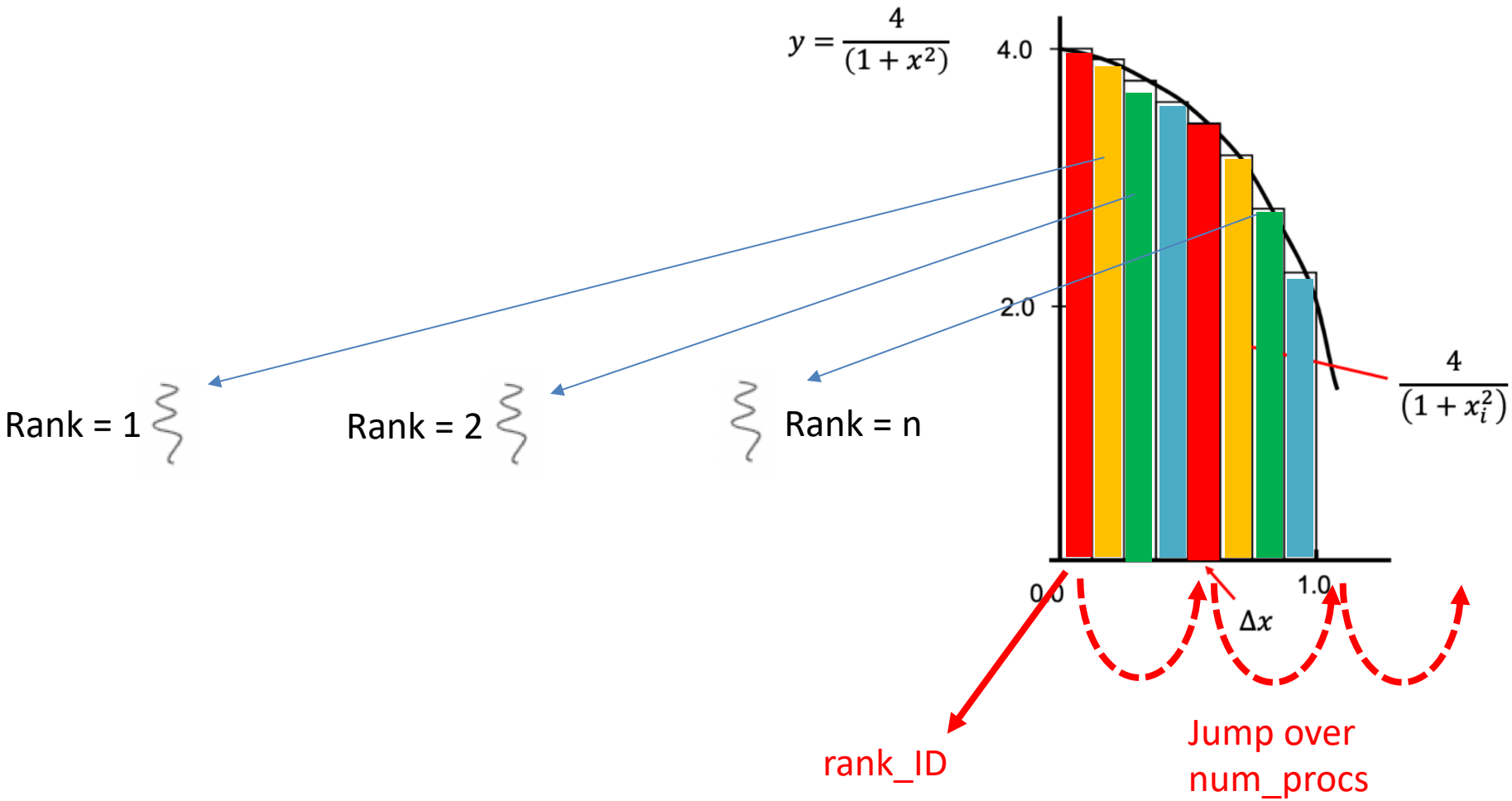
Project MPI

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



Project MPI

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

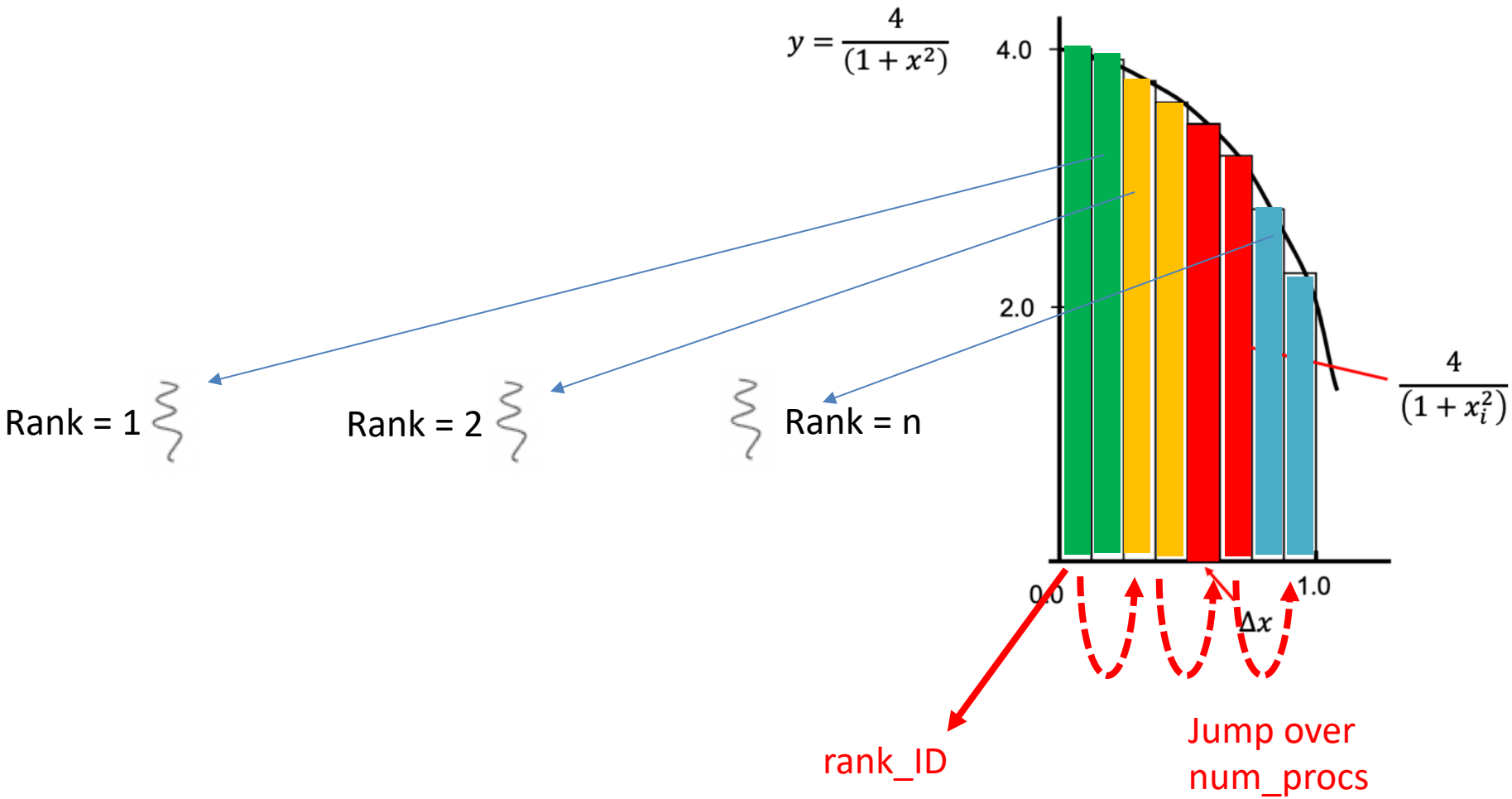


Project MPI

```
        sum = 0.0;
        double step = 1.0/(double) NUMSTEPS;

        local_x = 0.5 * step;
        for (i=my_rank;i<= n; i+=num_procs){   //each process jumps num_procs steps, calculate its local size
                local_x += step * num_procs;
                sum += 4.0/(1.0+local_x * local_x);
        }
        mypi = step * sum;    //mypi is the result of one process
        //dest process is 0, which is responsible to add all mypis into pi
```

Project MPI

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



Project MPI

```
administrator@ubuntu1804vm ~> mpiexec -n 2 pi-mpi.o
PI is 3.14159165358979830529
elapsed time = 7463985 nanoseconds
administrator@ubuntu1804vm ~> mpiexec -n 4 pi-mpi.o
PI is 3.14158965357486108516
elapsed time = 7745198 nanoseconds
administrator@ubuntu1804vm ~> mpiexec -n 8 pi-mpi.o
PI is 3.14158565355710805989
elapsed time = 9736663 nanoseconds
```

The value of PI is slightly different due to the sum up order

Result in a.aa:

2 digits

$3.332 \approx 3.33 + 1.999 = 5.329 \approx 5.33$

$1.555 + 1.777 + 1.999 = ?$

$3.776 \approx 3.78 + 1.555 = 5.335 \approx 5.34$