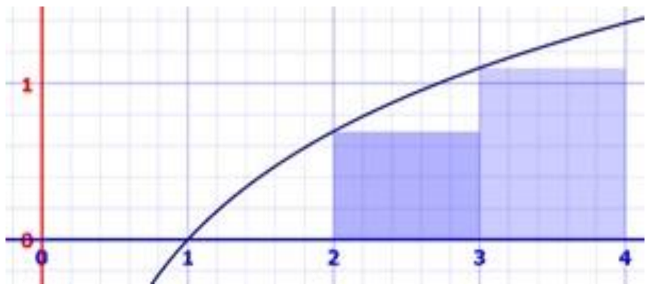
The Rectangle Method

- A definite integral $_a\int^b f(x)\,dx$ is the integral of a function *f(x)* with fixed end point *a* and *b*.
- The integral of a function *f(x)* is equal to the area *under* the graph of *f(x)*.

Let's use f**(x) = ln(x)** from x = a (lower step) to b (upper step), and n = number of rectangles



The width = (upper step – lower step) /n, the height = the functions value f(x).

The Area of each rectangle = width * height.

The total area = the summation of areas of all rectangles.

Example

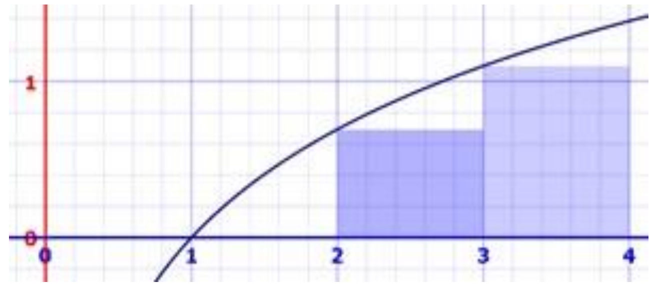
Let lower step =1, upper step =4, number of rectangles=3.

- *x=1 to 2:* ln(1) × 1 = 0 × 1 = 0
- *x=2 to 3:* ln(2) × 1 = 0.693147... × 1 = 0.693147...
- *x=3 to 4:* ln(3) × 1 = 1.098612... × 1 = 1.098612...

Adding these up gets **1.791759**, much lower than exact area. Why? Because we are missing all that area between the tops of the rectangles and the curve.

- We can minimize the error by increasing the number of rectangles (decreasing the width).
- We can perform the process to the left side (begun from x=a+w to x= b).

EX1: Write MATLAB code for using Rectangular method to find the area under the curve of **f(x) = ln(x)** within interval [1,4] and with subarea n= 3.




```
clc
clear all
close all
a=input('lower=');  %  a=1
b=input('upper=');  %  b=4
N=input('number of sub=');  % n=3

f=@(x)  log(x);  %% height
h=(b-a)/N;       %% width
sum=0;

for i=0:N-1

    sum=sum+h*f(a+i*h);      %% area = width*height

end
fprintf('area= %f\n',sum)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

EX2: Write MATLAB code for using Rectangular method to find the area under the curve of **f(x) = 2-x** within interval [0,2] and with subarea n= 4.

```
clc
clear all
close all
a=input('lower=');  %  a=0
b=input('upper=');  %  b=2
N=input('number of sub=');  % n=4

f=@(x)  2-x;  %% height
h=(b-a)/N;    %% width
sum=0;

for i=0:N-1

    sum=sum+h*f(a+i*h);      %% area = width*height

end
fprintf('area= %f\n',sum)
```