Numerical Integration.

Given the set of data points $(x_0,y_0), (x_1,y_1),$
..... (x_n,y_n) of function $y=f(x)$
where $f(x)$ is not known explicitly
- It is required to compute the value of
the definite integral.

$$I = \int_a^b y\, dx$$

→ In this case of numerical differention
one replaces $f(x)$ by interpolationg
polynominal $\phi(x)$ and obtains
But in
Integration an approximate value of
the definite integral.
- Here we defind different integration formule
that can obtained depending upon type
of interpolation formula used.

- Let the interval $[a,b]$ be divided into
n equal subintervals such that
$$a = x_0 < x_1 < x_2 < x_3 ... < x_n = b$$
clearly $x_n = x_0 + nh$
hence the integral becomes.

$$I = \int_{x_0}^{x_n} y\, dx.$$

* Trapezoidal Rule:-

- Let the interval $[a,b]$ be divided into n equal sub interval such that.
$a = x_0 < x_1 < x_2 \ldots < x_n = b$.
Clearly $x_n = x_0 + nh$.
hence the Trapezidal rule is given by.

$$\int_{x_0}^{x_n} y \, dx = \frac{h}{2}\left[y_0 + 2(y_1 + y_2 + \ldots y_{n-1}) + y_n\right]$$

where $h =$ is interval.

Q: Find, the from the following table, the area bounded by the curve and the x-axis from $x = 7.47$ and to $x = 7.52$

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93 y_0	1.95 y_1	1.98 y_2	2.01 y_3	2.03 y_4	2.06 y_5

we know that

$$Area = I = \int_{7.47}^{7.52} f(x)\, dx.$$

with $h = 0.01$, the trapoziodal Rule

$$Area = \frac{0.01}{2}\left[1.93 + 2(1.95 + 1.98 + 2.01 + 2.03) + 2.06\right]$$

$$= 0.0996.$$