Arithmetic Formulaes :

1. *For the numbers in arithmetic progression*,

N'th terms: $u_n = a + (n-1)d$

Where a = first terms, d = common difference.

N'th mean: $X_n = a + \frac{n(b-a)}{n-1}$

2. *For the arithmetic series*,

The last term $(1) = a + (n-1)d$

The sum, $S_n = \frac{1}{2}n\{2a + (n-1)d\} = \frac{1}{2}n(a+1)$

3. *Sum of squares of n natural numbers* $S_n = \frac{n(n+1)(2n+1)}{6}$

4. *Sum of cubes of n natural numbers* $S_n = \{\frac{n(n+1)}{2}\}^2$

5. *For the numbers in geometric progression*,

N'th term: $u_n = ar^{n-1}$ and n'th mean, $X_n = a\left(\frac{b}{a}\right)^{\frac{n}{n+1}}$

Geometric Series

1. *For the geometric series, the sum*

$S_n = \frac{a(r^n - 1)}{r - 1}$ if r > 1, $S_n = \frac{a(1 - r^n)}{1 - r}$ if r < 1

$S_n = \frac{a - rl}{1 - r}$ if, r < 1, $S_n = \frac{a}{1 - r}$ if n is very large,

2. *For any two numbers a and b.*

$\frac{a+b}{2} \geq \sqrt{ab}$ if $a \neq b$, $\frac{a+b}{2} = \sqrt{ab}$ if a = b

3. *Mean*

i. a. *Arithmetic mean* (A.M.) = $\frac{a+b}{2}$

b. For more arithmetic means "d" is to be found as $d = \frac{b-a}{n+1}$ then,

mean

$$M_1 = a + d \ M_2 = a + 2d \ M_3 = a + 3d \ldots \ \ldots \ \ldots \ \ldots$$

Where a = first term, b = last term, d = common difference

ii.a. Geometric mean (G.M) = $\sqrt{ab}$

b. For more geometri means "r" is to be found as

$r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$ then, mean

$$M_1 = ar \ M_2 = ar^2 \ M_3 = ar^3 \ \cdots \ \cdots$$

Where a = first term, b = last term, r = common ratio.

4. If AM & GM be the A.M. A\and G.M. between two positive numbers and b then $AM \geq GM$.

5. Sum of the first 'n' natural numbers (1+ +2 +3 + ……………………+ n) is $S_n = \frac{n}{2}(n+1)$.

6. Sum of the first 'n' odd natural numbers (1 + 3 + 5 + ………………………to n terms) is $S_n = n^2$

7. Sum of the first 'n' even natural numbers (2 +4 +6 + ……………………….to n terms) is $S_n = n(n+1)$

8. Sum of squares of the first 'n' natural numbers

$(1^2 + 2^2 + 3^2 + \cdots n^2)$ is $S_n = \frac{1}{6}n(n+1)(2n+1)$.

9. Sum of the cubes of first 'n' natural numbers

$(1^3 + 2^3 + 3^3 + \cdots + n^3)$ is $S_n = \{\frac{n(n+1)}{2}\}^2$.

10. $r = \frac{t_n}{t_{n-1}}$

11. $t_n = ar^{n-1}$

Simple Interest Formulas:

1. To calculate the total simple interest (S.I.) on a principle amount (P) at a certain rate per annum (R), after a certain years of time(T) is calculated using formula:

$$S.I. = \frac{P \times T \times R}{100}$$

2. If Amount (A) is the total amount to be paid to the lender at the end of lending term , Principal (P) is the total money lend from the lender , Interest (I) is the total interest accumulated , Rate of Interest (R) is the rate of interest per annum and Time (T) is the total time in years for which money is lend then,

$$A = P + I = P \times \left(\frac{100 + RT}{100}\right)$$

3. If "P" is the total principal or money lend , "A" is the total amount to be paid to lender at the end of lending term , "R" is the rate of interest per annum and "T" is total lending term in years then:

$$P = \frac{100 \times A}{RT + 100}$$

4. When , "T" is total lending term in years , "I" is the total Simple Interest accumulated in time "T" , "P" is the total principal lend and "R" is the rate of interest per annum then:

$$T = \frac{100 \times I}{PR}$$

5. To find the Rate of interest We can use following formula:

$$R = \frac{100 \times I}{PT}$$

Where, "R" is rate of interest , "I" is interest rate ,"P" is total principal and "T" is total time.

6. We can also calculate Principal amount by using formula:

$$P = \frac{100 \times I}{TR}$$

Where, “I” is rate of interest , “T” is total , “R” is rate of interest.

Please note that , In all of the above formulas , The unit of rate of interest (I) and Time (T) should be corresponding , for example if “R” is the rate on interest per month then “T” should be in months , If “R” is rate of interest per annum then “T” should be in Years.

1> **Derivative of Constant function or derivative of f(x)=y=c (c is a constant)**

Let Δx be a small increment in x and Δy be corresponding increment in y. Then,

$$f(x+\Delta x) = y + \Delta y = c$$

or, $\Delta y = c - y$

$= c - c$

$= 0$

and , $\dfrac{\Delta y}{\Delta x} = 0$

Thus , $\dfrac{dy}{dx} = \lim_{\Delta x \to 0} \dfrac{\Delta y}{\Delta x} = 0$

2> **Derivative of Identity function or derivative of f(x)=y=x**

Let Δx be a small increment in x and Δy be corresponding increment in y. Then,

$$f(x+\Delta x) = y + \Delta y = x + \Delta x$$

or, $\Delta y = x + \Delta x - y$

$= \Delta x$

and , $\dfrac{\Delta y}{\Delta x} = 1$

Thus, $\dfrac{dy}{dx} = \lim_{\Delta x \to 0} \dfrac{\Delta y}{\Delta x} = 1$

3> **Derivative of simple Quadratic function or derivative of f(x)=y=x^2**

Let Δx be a small increment in x and Δy be corresponding increment in y. Then,

$$f(x+\Delta x) = y + \Delta y = (x+\Delta x)^2$$

$= x^2 + 2.x.\Delta x + \Delta x^2$

or, $\Delta y = x^2 + 2.x.\Delta x + \Delta x^2 - y$

$= \Delta x(2x + \Delta x)$

and, $$\frac{\Delta x}{\Delta y} = 2.x + \Delta x$$

Thus, $$\frac{dy}{dx} = \lim_{\Delta x \to 0} 2x + \Delta x = 2x$$

4> **Derivative of Simple cubic function or derivative of f(x)=y=x^3**

Let Δx be a small increment in x and Δy be corresponding increment in y. Then,

$$f(x + \Delta x) = y + \Delta y = (x + \Delta x)^3$$
$$y + \Delta y = x^3 + 3x^2.\Delta x + 3x.\Delta x^2 + \Delta x^3$$

or, $$\Delta y = x^3 + 3x^2.\Delta x + 3x.\Delta x^2 + \Delta x^3 - y$$
$$= 3x^2.\Delta x + 3x.\Delta x^2 + \Delta x^3$$
$$= \Delta x(3x^2 + 3x.\Delta x + \Delta x^2)$$

and, $$\frac{dy}{dx} = 3x^2 + 3x.\Delta x + \Delta x^2$$

Thus,

The Conclusion:

If we analysis above four examples and also analysis the derivative of higher degree of functions

Then we can see the following result:

Derivative of simple algebraic functions or polynomial function

like function f(x)=y=x^n

is n.x^{n-1}

or, $$\frac{dx^n}{dx} = n.x^{n-1}$$

Derivative:

When a variable "y" is defined as a function of another variable "x" or,

f(x)=y

Then , The Derivative or Differential Coefficient of the function "f" at a point "x" or with respect to "x" is the limiting value of:

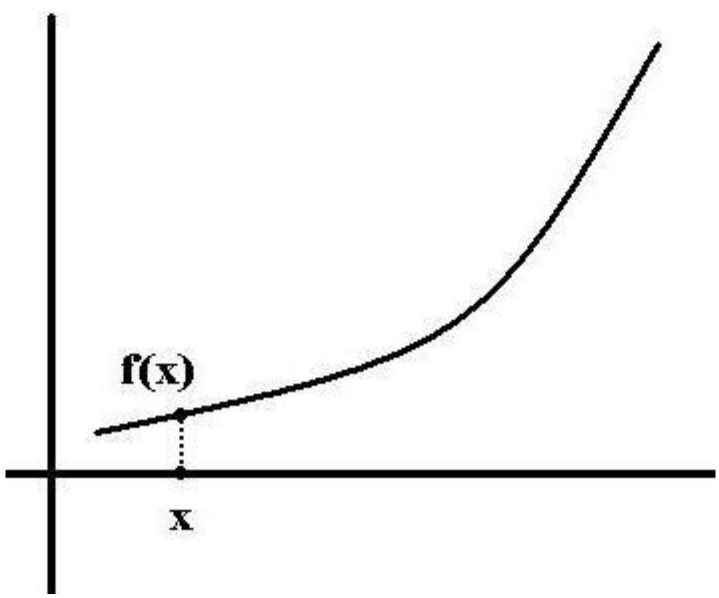
$$\lim_{x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

The derivative of a function of "x" with respect to "x" is denoted by:

$$\frac{df(x)}{d(x)}$$

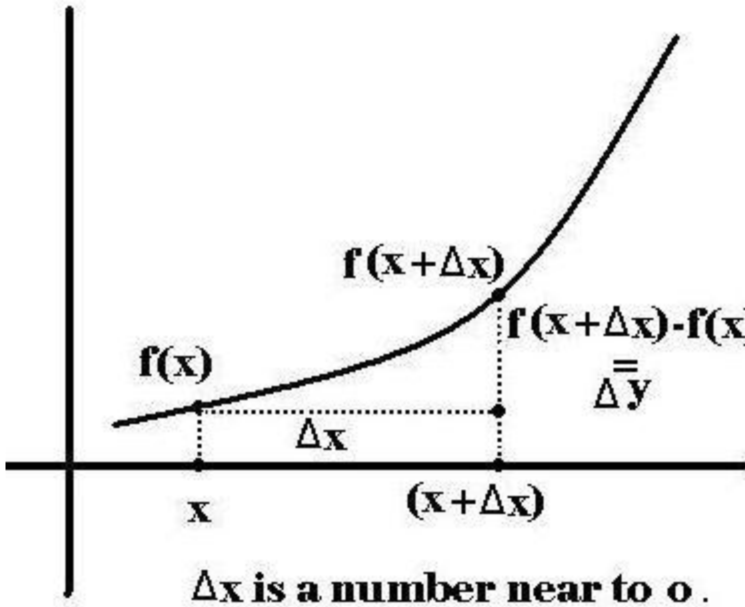
for example:

If "y" is a function of "x" or f(x)=y whose graph looks like:



Then the derivative of the function "f" with respect to "x" at point "x" is :-

which can be shown in figure as:


f(x+Δx)
f(x+Δx)-f(x)
=
Δy
f(x)
Δx
x
(x+Δx)
Δx is a number near to o.