(mathematics)

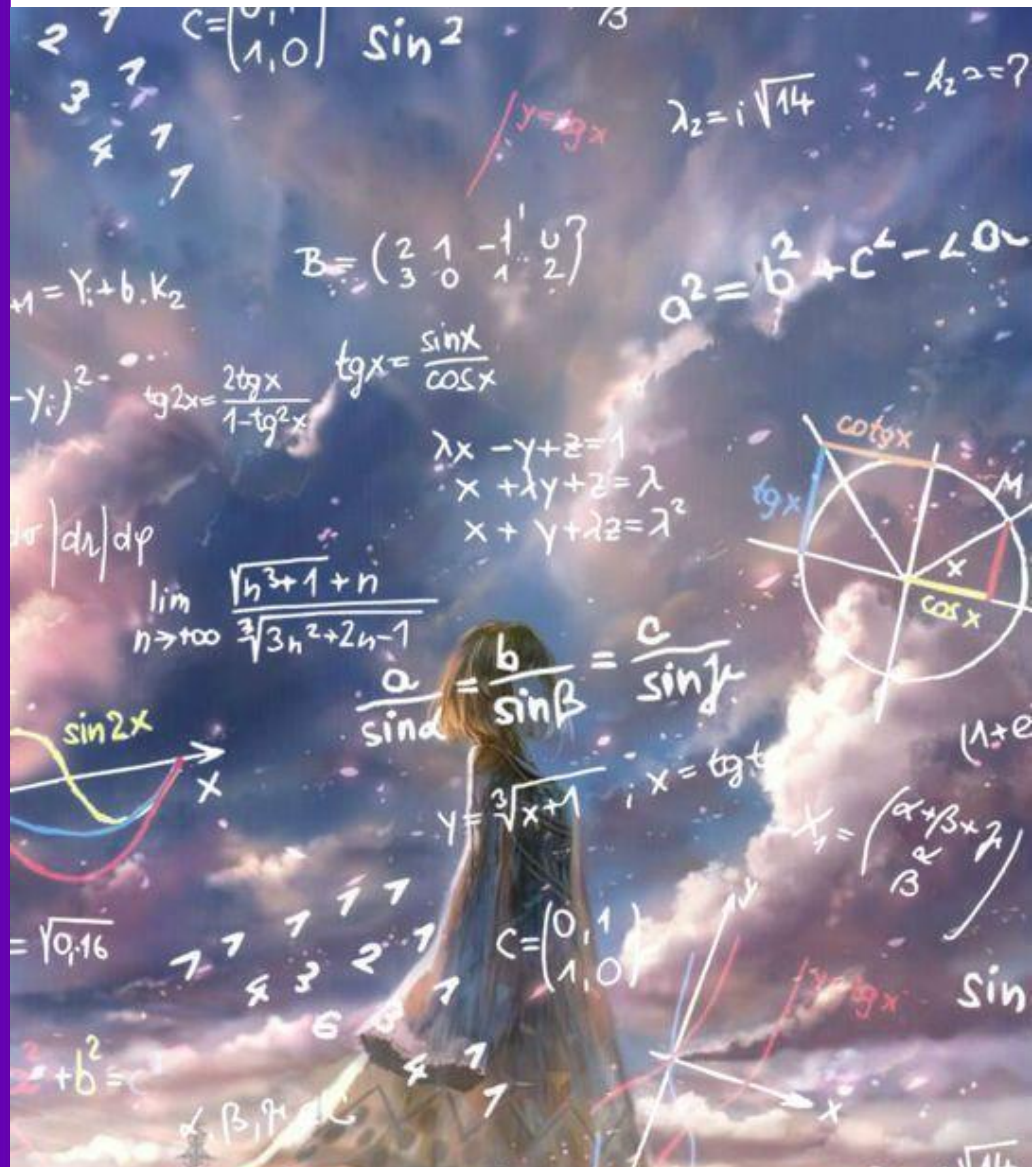
Secondary 2

2 nd term

calculus

unit 3 lesson 1

(Rate of change)



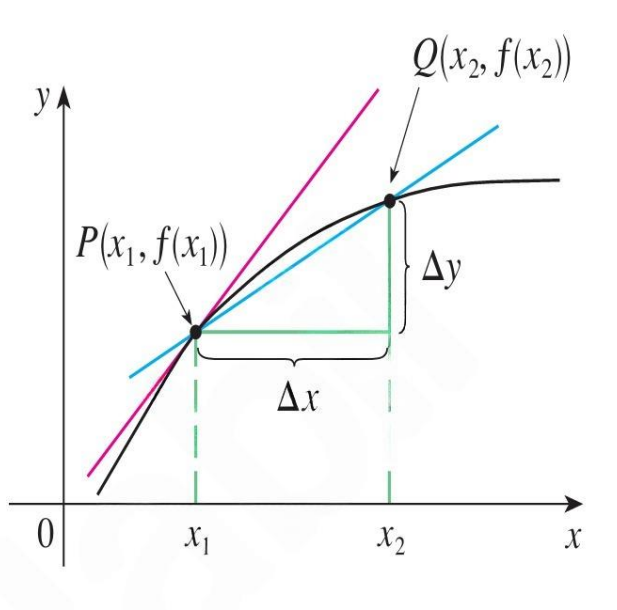
Variation function

$y = f(x)$. If x changes from x , to x_2 , then the change in x

$$\Delta x = x_2 - x_1$$

and the corresponding change in y is

$$\Delta y = f(x_2) - f(x_1)$$



Variation function

Let x, and x, + h belong to the domain of the function f , then for every variation in x , with value (h)
X changes from X, to X, + h. there is a corresponding variation in y determined by the function V where

$$V(h) = f(X_1, + h) - f(X_1)$$

The function V (h) is called the variation function of at

$$X = X_1$$

The difference quotient

- $$\frac{\Delta y}{\Delta x} = \frac{f(x2) - f(x1)}{X2 - X1}$$

Example (1)

If f (x) = x^2 -3 X + 4 , then find:

1) The variation function of f (X) at X = 3 , then find V (0.2)

2) The value of variation of f (X) as X changes from 1 to 1.4

Solution: (1)

Example (2)

Given that : $f(X) = 2X^2 + 5X - 1$, then find :

(1) The average rate of change of f at X = 2, then find A (0.2)

(2) The average rate of change of f as X changes from 5.5 to 4

Solution: (2)

Rates of Change:

instantaneous rate of change $= \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{x_2 \to x_1} \frac{f(x2) - f(x1)}{X2 - X1}$

- **If the average rate of change function A (h) has a finite limit as h $\to$0 , then this limit is called the rate of change of this function at $X = X_1$**

∴The rate of change of the function F at X_1=

Lim A (h)= Lim $\frac{f(x^1+h)-f\,(x_1)}{h}$

$h \to 0$ $\quad$ $h \to 0$

Example (3)

- **Find the average rate of change of the function,**

Find the derivative of: x^2 **- 2 at x= 10**

Solution:

Example (4)

- **Find the average rate of change of the function,**

Find the derivative of: 99x at x = 100

Solution:

Example (5)

- **Find the average rate of change of the function,**

Find the derivative of: x at x =1

Solution:

Example (6)

- **Given that:** $f(X) = \sqrt{x}\ .X \geq 0$
- **find the rate of change of the function at $X = X_1$, then find this rate at $X_1 = 25$**

Solution:

Example (7)

- **A metallic lamina in the shape of a square is expanding by heating, such that its shape does not change. Find:**

(1)The average rate of change of its surface area, when its side length changes from 10 to 10.2 cm

(1)The rate of change of its surface area, when its side length is equal to 20 cm

Solution: (7)

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