

OMEGA ACADEMY, NUMERICAL METHODS COURSE.

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Numerical Methods

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**Guide numerical methods.
Multimedia Engineering and Systems Engineering**



UNIT SIX

Numerical Derivation

Numerical analysis techniques are used to calculate the approximation to the derivate of a function, these being important in the solution of ordinary derivate equations and partial derivate equations.

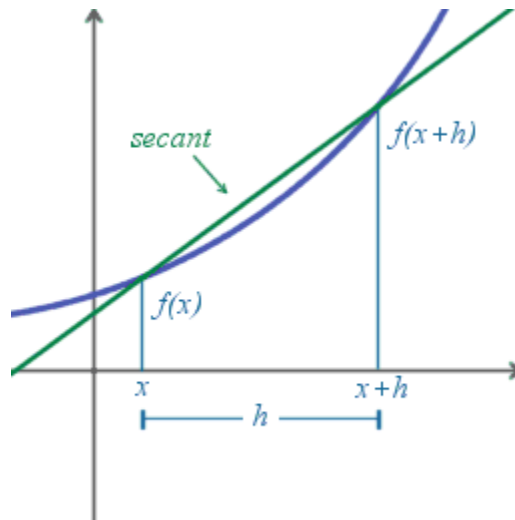


Figure 1: Graphical approach to the derivative of a function Taken from http://es.wikipedia.org/wiki/Derivaci%C3%B3n_num%C3%A9rica#mediaviewer/File:De_Derivative.png

To perform the developing function by numerical derivation must use the following formulas.

Formula first derivative:

$$f'(x_i) = \frac{-f(x_i + 2h) + 4f(x_i + h) - 3f(x_i)}{2h}$$

Formula second derivative:

$$f''(x_i) = \frac{-f(x_i + 3) + 4f(x_i + 2) - 5f(x_i + h) + 2f(x_i)}{h^2}$$

Formulate third derivative:

$$f'''(x_i) = \frac{-3f(x_i + 4) + 14f(x_i + 3) - 24f(x_i + 2) + 18f(x_i + 1)}{2h^3}$$

You can also apply the following formulas, which are used in the development of the procedure that follows.

Formulas:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

Image 1: first derivative

$$f''(x_0) \approx \frac{f(x_0 + h) - 2f(x_0) + f(x_0 - h)}{h^2}$$

Image 2: second derivative

- Find the derivative of the following function

$$\sin(x)$$

Starting point

$$X_i=2$$

Set h

$$h=0.001$$

$$F'(X_i) = \frac{f(2+0,001) - f(2)}{0,001}$$

$$F'(X_i) = \frac{f(2,001) - f(2)}{0,001}$$

$$\sin(2,001) = 0,9088$$

$$\sin(2) = 0,9092$$

$$F'(X_i) = \frac{0,9088 - 0,9092}{0,001} = -0,4$$