OMEGA ACADEMY, NUMERICAL METHODS COURSE.

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Numerical Methods

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UNIT FOUR

Newton Raphson Method.

This method is best used in engineering because with it you get a quick way to solve the problem. Consists of drawing tangents that through its first derivative, it will take the form of the function. It is an iteration method that approximates a solution of an equation of type f (x) = 0

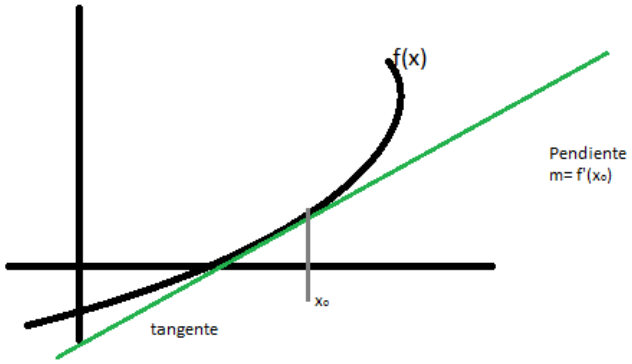

Image 1: Graphic

Equation of the tangent line.

$$y - f(x) = f'(xo)\,(x - xo)$$

The line goes straight through the x axis then

$$0 - f(xo) = f'(xo)\,(x1 - xo)$$

$$\frac{-f(xo)}{f'(xo)} = x1 - xo$$

$$\boxed{x1+1 = xo - \frac{f(xo)}{f'(xo)}}$$

This method does not work at intervals that will ensure that we will find the root nor guarantees we get closer to that root. However on the occasions that if converges to the root of what makes a very fast, which is why it is one of the methods used by excellence.

We can also note that in the case f (xo) = 0, this method cannot be applied. Geometrically this means that the tangent line is horizontal and thus the x-axis does not intersect at any point.

Apply Newton Raphson method follows function, since f (x) = 0:

$$f(xo) = e^x - \frac{1}{x}$$

Calculate its derivative

$$f'(xo) = e^x + \frac{1}{x^2}$$

Then we replaced in formula

$$\boxed{x1+1 = xo - \frac{f(xo)}{f'(xo)}}$$

$$\boxed{x1+1 = xo - \frac{e^x - \frac{1}{x}}{e^x + \frac{1}{x^2}}}$$

An initial estimate of the solution is taken. It is taken for example x_0 = 1, and the following approximations are calculated

$$x_0 = 1$$

$$x_1 = 1 - \frac{e^1 - \frac{1}{1}}{e^1 + \frac{1}{1^2}} = 0.53788284$$

$$x_2 = x_1 - \frac{e^{x_1} - \frac{1}{x_1}}{e^{x_1} + \frac{1}{{x_1}^2}} = 0.56627701$$

$$x_3 = x_2 - \frac{e^{x_2} - \frac{1}{x_2}}{e^{x_2} + \frac{1}{{x_2}^2}} = 0.56714258$$

$$x_4 = x_3 - \frac{e^{x_3} - \frac{1}{x_3}}{e^{x_3} + \frac{1}{{x_3}^2}} = 0.56714329$$

$$x_5 = x_4 - \frac{e^{x_4} - \frac{1}{x_4}}{e^{x_4} + \frac{1}{{x_4}^2}} = 0.56714329$$

It can be taken as a solution

$$x = 0.567143$$