3.NEWTON RAPHSON METHOD:

The **Newton-Raphson method** (also known as Newton's method) is a way to quickly find a good approximation for the root of a real-valued function $f(x) = 0$f(x)=0. It uses the idea that a continuous and differentiable function can be approximated by a straight line tangent to it.

FORMULA:

$xn+1 = xn+1 = xn - \frac{f'(x_n)}{f(x_n)}$

ADVANTAGES:

1.Converges fast(quadratic convergence) ,if it converges.

2.Requires only one guess.

DISADVANTGES:

Divergence at inflection points: Selection of the initial guess or iteration of the root that is close to the inflection point of the function f(x) may start diverging away from the root in the Newton-Raphson method.

Example:

f(x)=cosx-x^{e^x}

f(0) =1

f(1) =-2.17

So, points are (0,1).

f'= -sinx-xe^x+e^x

Now put in

$xn+1 = xn+1 = xn - \frac{f(x_n)}{f'(x_n)}$

$x_{n+1}=x_n-\frac{(\cos x - xe^x)}{(-\sin x - xe^x + e^x)}$

$x_{n+1}=x_n-\frac{\cos x_n - xne^{x_n}}{e^x - xe^x - \sin x}$

x_0=-1.86

n=0

x_1=-1.8631

n=2

x_2*=-1.8638*

n=3

x_3*=-1.8640*

n=4

x_4*=-1.8640*

Hence, roots are –1.8640 for Newton-Raphson method.

Error:

Formula for error is: $|Ea|$ = $\left|\frac{x_{new}-x_{old}}{x_{new}}\right| \times 100$

$=\left|\frac{1.8640-1.8640}{1.8640}\right| \times 100$

=0%.