

Newton-Raphson Method: Example



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- Click on Newton-Raphson Method



Solve the nonlinear equation $x^3 = 20$ by Newton-Raphson method using an initial guess of $x_0 = 3$.

Conduct two iterations to estimate the root of the above equation. ✓

Find the absolute relative approximate error at the end of each iteration. ✓

Find the number of significant digits at least correct at the end of each iteration. ✓

$$x^3 = 20$$

$$f(x) = 0$$

$$f(x) = x^3 - 20 = 0$$

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

$$f'(x) = \frac{d}{dx} (x^3 - 20) = 3x^2$$



$$X_{i+1} = X_i - \frac{f(x_i)}{f'(x_i)}$$

$$= X_i - \frac{X_i^3 - 20}{3X_i^2}$$

Iteration 1 $i=0$

$$X_1 = X_0 - \frac{X_0^3 - 20}{3X_0^2}$$

$$= 3 - \frac{3^3 - 20}{3(3)^2}$$

$$= 2.74074$$



Iteration 2 $n=1$

$$X_2 = X_1 - \frac{X_1^3 - 20}{3X_1^2}$$

$$= 2.74074 - \frac{2.74074^3 - 20}{3(2.74074)}$$

$$= 2.71467$$

$$|\epsilon_{rel}| = \left| \frac{X_2 - X_1}{X_2} \right| * 100$$

$$= \left| \frac{2.71467 - 2.74074}{2.71467} \right| * 100$$

$$= 0.960\%$$

$m=1, |\epsilon_{rel}| \leq 5\%$

$m=2, |\epsilon_{rel}| \leq 0.5\%$

$m=1$

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