By using Newton Raphson Method, $x^4-x-10=0$ which is nearest to 2, find real root correct to three decimal places? (R.G.P.V. 2022 NOV)

Solution:

Let,

$$F(x) = x^4 - x - 10$$

Newton Raphson Formula: Xn+1= Xn - f(Xn)/f'(Xn)

Here,

f'(Xn)= 4x^3-1

According to the question, it will be given x0=2...

 $X0+1= x0- (x0^{(4)}-x0-10)/(4\times0^{(3)}-1)$

 $X1 = x0 - (x0^{(4)} - x0 - 10)/(4 \times 0^{3} - 1)$

Put the value of xo=2;

 $X1 = 2 - (2^{(4)} - 2 - 10)/(4 + 2^{(3)} - 1)$

X1=2- (16-12)/4*8-1

X1=2-4/13

$$X1 = 1.871$$

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Here x1= 1.871, and n=1

 $Xn+1= Xn- (Xn^{(4)}-Xn-10)/(4Xn^{(3)}-1)$

Put the value of n=1

 $X1+1= X1-(X1^{(4)}-X1-10)/(4X1^{(3)}-1)$

Put the value of x1 = 1.871

X2= 1.871- (1.871⁽⁴⁾- 1.871-10)/(4*1.871⁽³⁾-1)

$$X2 = 1.856$$

Here, x2 = 1.856, and n = 2

Put n = 2

X2+1= X2- (X2^(4)-X2-10)/(4X2^(3)-1)

Put the value of $x^2 = 1.856$

X3= 1.856 - (1.856⁽⁴⁾-1.856-10)/(4*1.856⁽³⁾-1)

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Since, x2=x3, so the real root correct to three decimal place is 1.856.

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