

Question 1:

Find a root of the given equation using Newton-Raphson Method.
Keep values correct to four decimal places.

$$x^3 + 2x^2 + 10x - 20 = 0$$

Take initial value $x_0 = 1.5$

Solution:

$$X^3 + 2x^2 + 10x - 20 = 0$$

Taking initial value $x_0 = 1.5$

$$X^3 + 2x^2 + 10x - 20 = 0$$

$$f(x) = x^3 + 2x^2 + 10x - 20$$

$$d/dx(x^3 + 2x^2 + 10x - 20)$$

$$= 3x^2 + 4x + 10$$

$$f'(x) = 3x^2 + 4x + 10$$

$$x_0 = 1.3736$$

Iteration 01:

$$f(x_0) = f(1.5) = 2.875$$

$$f'(x_0) = f'(1.5) = 22.75$$

$$x_1 = x_0 - f(x_0)/f'(x_1)$$

$$x_1 = 1.3736$$

Iteration 2:

$$f(x_1) = f(1.3736) = 0.1018$$

$$f'(x_1) = f'(1.3736) = 21.1551$$

$$x_2 = x_1 - f(x_1)/f'(x_1)$$

$$x_2 = 1.3688$$

Iteration 3:

$$f(x_2) = f(1.3688) = 0.0001$$

$$f'(x_2) = f'(1.3688) = 21.0962$$

$$x_3 = x_1 - f(x_2)/f'(x_2)$$

$$x_3 = 1.3688$$

Hence the calculated root of the given equation using Newton-Raphson Method. Upto four decimal places is 1.3688

Question 2:

Find a root of the given equation using three iterations by Bisection method

$$x^3 - x - 11 = 0$$

Identify the initial bracket (x_0, x_1) first.

Solution:

X	0	1	2	3
F(x)	-11	-11	-5	-13

Solution:

$$x^3 - x - 11 = 0$$

$$f(x) = x^3 - x - 11$$

$$f(2) = -5 < 0 \text{ and } f(3) = 13 > 0$$

Now root lies between 2 and 3

Iteration 1:

$$f(2) = -5 < 0 \text{ and } f(3) = 13 > 0$$

$$x_0 = 2 + 3/2 = 2.5$$

$$f(x_0) = f(2.5) = 2.215 > 0$$

Iteration 2:

$$f(2) = -5 < 0 \text{ and } f(2.5) = 2.125 > 0$$

$$x_1 = 2 + 2.5/2 = 2.25$$

$$f(x_1) = f(2.25) = 1.8594 < 0$$

hence root lies between 2 and 2.25

Iteration 3:

$$f(2.25) = 1.8594 < 0$$

$$f(2.25) = 2.125 > 0$$

Now root lie between 2.25 and 2.50
 $X_2 = 2.25 + 2.5/2 = 2.375$