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Cource title: Numerical Mathods

Cource Code: MAT-415

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Ans to the Que No 1

Let, $x = \frac{8}{9}$

$x' = 0.8889$

Now, (a) Absolute Error $= E_A = |x - x'|$

$$= \left|\frac{8}{9} - 0.8889\right|$$

$$= \left|\frac{8 - 8.0001}{9}\right|$$

$$= 0.000011$$

(b) Relative Error $= E_R = \frac{E_A}{|x|}$

$$= \frac{\left|\frac{8}{9} - 0.8889\right|}{\frac{8}{9}}$$

$$= |1 - 1.0000125|$$

$$= 0.0000125$$

(c) Preentage Error $= E_R \times 100$

$$= 0.0000125 \times 100$$

$$= 0.00125.$$

PTO

Ans to the Que NO 3

let,

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

-2
$\uparrow$
-1.6975
$\downarrow$
-1

$\therefore f(-2) = (-2)^4 - (-2) - 10 = 8 > 0$

$f(-1) = (-1)^4 - (-1) - 10 = -8 < 0$

$\therefore f(-2)$ and (-1) are of opposite signs. so at least one root of the given equation lies between -2 and -1

Iteration - 1

let, $x_0 = \frac{-2-1}{2} = -1.5$

$\therefore f(x_0) = f(-1.5) = (-1.5)^4 - (-1.5) - 10 = 3.4375 < 0$

$\therefore$ The root lies between -2 and -1.5

Iteration - 2

let, $x_1 = \frac{-2-1.5}{2} = -1.75$

$\therefore f(x_1) = f(-1.75) = (-1.75)^4 - (-1.75) - 10$
$= 1.1289 > 0$

The root lies between -1.75 and -1.5

P.T.O

Iteration-3

let $x_2 = \frac{-1.75-1.5}{2} = -1.625$

$\therefore f(x_2) = f(-1.625) = (-1.625)^4 - (-1.625) - 10$
$= -1.4021 < 0$

The root lies between -1.75 and -1.625

Iteration-4

let, $x_3 = \frac{-1.75-1.625}{2} = -1.6875$

~~$\therefore f(x_3) = f(-1.6$~~

$\therefore f(x_3) = f(-1.6875) = (-1.6875)^4 - (-1.6875) - 10 = -0.2034 < 0$

The root lies between -1.75 and -1.6875

Iteration 5

let, $x_4 = \frac{-1.75-1.6875}{2} = -1.71875$

$\therefore f(x_4) = f(-1.71875) = (-1.71875)^4 - (-1.71875) - 10 = 0.4455 > 0$

The root lies between -1.71875 and -1.6875

Iteration 6,

let $x_5 = \frac{-1.71875-1.6875}{2} = -1.70313$

$\therefore f(x_5) = f(-1.70313) = (-1.70313)^4 - (-1.70313) - 10 = 0.1169 > 0$

The root lies between -1.70313 and -1.6875

P.T.O

Iteration - 7,

$$\text{let } x_6 = \frac{-1.70313 - 1.6875}{2} = -1.69531$$

$$\therefore f(x_6) = f(-1.69531) = (-1.69531)^4 - (-1.69531) - 10 = -0.04438 < 0$$

The root lies ~~bet~~ between -1.70313 and -1.69531

Iteration - 8,

$$\text{let } x_7 = \frac{-1.70313 - 1.69531}{2} = -1.69922$$

$$\therefore f(x_7) = f(-1.69922) = (-1.69922)^4 - (-1.69922) - 10 = 0.03600 < 0$$

$\therefore$ The required root lies between -1.69531 and -1.69922

From hear it evident that upto two decimal places the required root of the given equation is -1.69.

Ans to the Que NO-04

let $f(x) = x^3 - 4x - 9$

Since,

$f(2) = (2)^3 - 4\times2 - 9 = -9$

$f(3) = (3)^3 - 4\times3 - 9 = 6$

Here, $a=2$, $b=3$

$\therefore f(a) \times f(b) = -9\times6 = 54 < 0$

At least one root of the equation lies between [2,3]

a	b	$f(a)$	$f(b)$	$c = \frac{a\times f(b) - b\times f(a)}{f(b) - f(a)}$	$f(c)$
2	3	-9	6	2.6	-1.824
2.6	3	-1.824	6	2.693	-0.242
2.693	3	-0.242	6	2.704	-0.045
2.704	3	-0.045	6	2.706	-0.948

From here it is evident that upto two decimal places the required root of given equation is 2.70

P.T.O

Ans to the Que No -05

let, $f(x) = x^3 - 4x - 9 = 0$

$\Rightarrow x^3 - 4x - 9 = 0$

$\Rightarrow x^3 = 9 + 4x$

$\Rightarrow x = \sqrt[3]{4x+9}$

$\Rightarrow x = g(x)$

where, $g(x) = \sqrt[3]{4x+9}$

let $x_0 = 1$

$x_1 = g(x_0) = g(1) = (4\times1+9)^{1/3} = 2.3513$

$x_2 = g(x_1) = g(2.3513) = (4\times2.3513+9)^{1/3} = 2.6403$

$x_3 = g(x_2) = g(2.6403) = (4\times2.6403+9)^{1/3} = 2.6944$

$x_4 = g(x_3) = g(2.6944) = (4\times 2.6944+9)^{1/3} = 2.7043$

$x_5 = g(x_4) = g(2.7043) = (4\times2.7043+9)^{1/3} = 2.7061$

$x_6 = g(x_5) = g(2.7061) = (4\times2.7061+9)^{1/3} = 2.7064$

Due to repetation of x_5 and x_6, we stop our work. Thus the required root is 2.706 correct to three decimal places.

Again,

let $x_0 = 2$

~~$x_1 = $~~

$x_1 = g(x_0) \equiv g(2) = (4\times2+9)^{1/3} = 2.571$

$x_2 = g(x_1) = g(2.571) = (4\times2.571+9)^{1/3} = 2.682$

$x_3 = g(x_2) = g(2.682) = (4\times2.682+9)^{1/3} = 2.702$

$x_4 = g(x_3) = g(2.702) = (4\times2.702+9)^{1/3} = 2.706$

$x_5 = g(x_4) = g(2.706) = (4\times2.706+9)^{1/3} = 2.706$

Due to repetation of x_4 and x_5, we stop our work. Thus the required root is 2.706 correct to three decimal place.

Ans to the Que NO - 6 (i)

Converting the binary to decimal

$(0111.0111)_2 = 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0 + 0\times2^{-1} + 1\times2^{-2}$
$+ 1\times2^{-3} + 1\times2^{-4}$

$= 0 + 4 + 2 + 1 + 0 + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$

$= 4+2+1+0.25+0.125+0.0625$

$= (7.4375)_{10}$

Here is the answer, The binary Number $(0111.0111)_2$ converted to decimal is therefore equal to $(7.4375)_{10}$

Ans to the Que NO - 6(ii)

Converting the hexadecimal Number to decimal number

$$(F2C.A)_{16} = F\times16^2 + 2\times16^1 + C\times16^0 + A\times16^{-1}$$

$$= 15\times256 + 2\times16 + 12\times1 + 10\times\frac{1}{16}$$

$$= 3840 + 32 + 12 + 0.625$$

$$= (3884.625)_{10}$$

Here is the final Answare,

The Hexadecimal Number $(F2C.A)_{16}$ Converted to decimal is therefor equal to $(3884.625)_{10}$.

END.