

27th
NOV

Rounding off the digits upto 3 significant digits

2, 6, 4 → 3 significant digit

2.643

3 cases

< 5

∴ 2.643
= 2.64

= 5

2.655
= 2.64

(+1)

odd

2.645

= 2.64

EVEN

> 5

∴ 2.647
= 2.65

(+1)

Error calculation

① Absolute error

$$E_a = |x - x'|$$

⑩ Relative error

$$Er = \left| \frac{x - x'}{x} \right|$$

TRUE value APPROX. value

⑪ Percentage Error

$$Ep = 100 * \left| \frac{x - x'}{x} \right|$$

1. Round off the nos. 865250 & 37.96235 to 4 significant figures & compute Er , Ei , Ep case

① 865250

TRUE / ACTUAL value
↓
x

even
x = 8652 50

so,

no change

∴ x' = 8652 00

$$E_q = |x - x'|$$

$$= 1865250 - 8652001$$

$$= 50$$

$$E_r = \frac{|x - x'|}{x}$$

$$= 0.00005778676$$

$$E_p = 100 * E_r$$

$$= 0.005778676 \%$$

③ 37.46235

$$x = 37.46235$$

$$x' = 37.46000$$

Then,

$$E_q = |x - x'|$$

$$= 0.00235$$

$$E_r = \frac{|x - x'|}{x}$$

$$= 0.000062729$$

$$E_p = 100 * E_r$$

$$= 0.00627 \%$$

map-2

Solving of Non-Linear Eqⁿs

Non-Linear Eqⁿ solver

(i) Bracketing methods

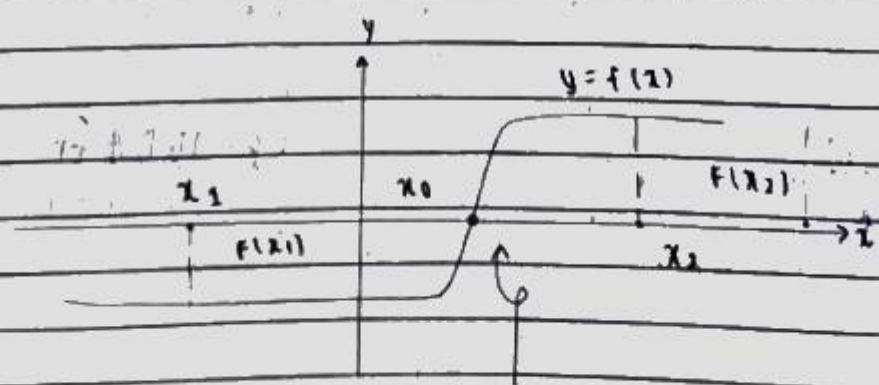
- Bisection method
- False method

(ii) Graphical

(iii) Non-Bracketing methods

- (open method)
- secant method
- Newton Raphson method

All Iterative process



Required root

curve ko jaha x-axis ko cut garxa

• Note: calculator in Radian
not degree



① Bisection method

↳ Also called as Boltzno method

↳ most simplest & reliable method for finding soln of non-linear eqⁿ

↳ let x_1 & x_2 be two points betⁿ which root lies then,

the 1st approximate root is

$$x_0 = \frac{x_1 + x_2}{2}$$

Now, there exists a following three condⁿ

① $f(x_0) = 0$

x_0 is the **exact root** of the given eqⁿ

② $f(x_0) \cdot f(x_1) < 0$

there is a **root betⁿ**

✓
 x_0 & x_1

③ $f(x_0) \cdot f(x_2) < 0$

there is a **root betⁿ**

✓
 x_0 & x_2

Here,

two initial guess x_1 & x_2 must bracket the root

stopping
criteria

decimal part no
second last & last step no 2 decimal places ko
digit same vaye stop

decimal places ko
Date _____
Page _____

1. Find a root of eqn $x^2 - 4x - 10 = 0$ using
bisection method correct upto 2 decimal
place

Soln

let $f(x) = x^2 - 4x - 10$

(i) make base table

(ii) gn ko eqn lenhne

(iii) start ? -5
End ? 10

(iv) step 1 (as is)

(v) x_1 & x_2 yesto garera line that cuts the
x-axis, and is -ve dinxa

na jik ko value line

(vi) root ko aita value hunxa

the

-ve

if you exam

the root ✓ ma sodhya

xa rane

-ve value of $f(x)$

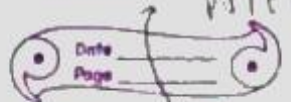
1.5, 5 jastai

x_1 & x_2 ko value the line

the value of $f(x)$

stopping criteria
yesko check
garne

EXAM mg
parent



Iteration	x_1	x_2	$f(x_1)$	$f(x_2)$	x_0	$f(x_0)$	Remarks
1	-2	-1	2	-5	-1.5	-1.75	$f(x_0) \neq f(x_1)$ < 0
2	-2	-1.5	2	-1.75	-1.75	0.0625	$f(x_0) \neq f(x_2)$ $f(x_2) < 0$
3	-1.75	-1.5	0.0625	-1.75	-1.625	-0.859375	$f(x_1) \neq f(x_2)$ < 0
4	-1.75	-1.625	0.0625	-0.859375	-1.6875	-0.40234375	$f(x_0) \neq f(x_2)$ < 0
5	-1.75	-1.6875	0.0625	-0.40234375	-1.71875	-0.1708984375	$f(x_0) \neq f(x_2)$ < 0
6	-1.75	-1.71875	0.0625	-0.1708984375	-1.734375	-0.05443359375	$f(x_0) \neq f(x_2)$ < 0
7	-1.75	-1.734375	0.0625	-0.05443359375	-1.7421875	0.00390625	$f(x_0) \neq f(x_2)$ $f(x_2) < 0$
8	-1.7421875	-1.734375	0.00390625	-0.05443359375	-1.73828125	-0.025234375	$f(x_0) \neq f(x_2)$ $f(x_1) < 0$
9	-1.7421875	-1.73828125	0.00390625	-0.025234375	-1.740625	-0.01064453125	$f(x_0) \neq f(x_2)$ $f(x_1) < 0$
10	-1.7421875	-1.740625	0.00390625	-0.01064453125	-1.74125	-0.0033203125	$f(x_0) \neq f(x_2)$ $f(x_1) < 0$

Hence, the reqd. root of given eqn is -1.74.

Q.11.2 Find at least one root of $x^3 - 2x - 5 = 0$ using bisection method. Correct upto 3 decimal place

Soln

Let $f(x) = x^3 - 2x - 5$

x
 $f(x)$

Iteration	x_1	x_2	$f(x_1)$	$f(x_2)$	x_0	$f(x_0)$	Remark
1.	2	3	-1	16	2.5	5.625	$f(x_1) \cdot f(x_2) < 0$
2.	2	2.5	-1	5.625	2.25	1.890625	$f(x_1) \cdot f(x_2) < 0$
3.	2	2.25	-1	1.890625	2.125	0.3457	$f(x_1) \cdot f(x_2) < 0$
4.	2	2.125	-1	0.3457	2.0625	-0.351	$f(x_1) \cdot f(x_2) < 0$
5.	2.0625	2.125	-0.351	0.3457	2.09375	-0.0089	$f(x_1) \cdot f(x_2) < 0$
6.	2.09375	2.125	-0.0089	0.3457	2.109375	0.16683	$f(x_1) \cdot f(x_2) < 0$
7.	2.09375	2.109375	-0.0089	0.16683	2.1015625	0.01866	$f(x_1) \cdot f(x_2) < 0$

8.	2.09375	2.10156	-0.0089	0.07856	2.09765	0.03471	$f(x_0) \neq f(x_1)$
		25	4165039	2250	625	428157	<0
9	2.09375	2.09765	-0.0089	0.03471	2.095	0.0128	$f(x_0) \neq f(x_1)$
		625	4165039	428157	703125	6233217	<0
10.	2.09375	2.09510	-0.0089	0.01286	2.09472	0.001954	$f(x_0) \neq f(x_1)$
		3125	4165039	233217	6563	39782	<0
11.	2.09375	2.09472	-0.0089	0.00195	2.0942	-0.0039	$f(x_0) \neq f(x_1)$
		6563	4165039	43782	38282	951964	<0

Hence, the reqd. root of given eqⁿ is 2.094.