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Roll → 74
Paper → Numerical methods.
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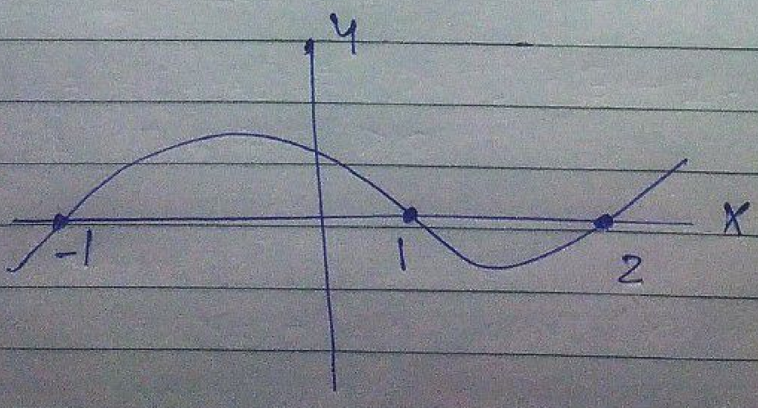
[ANSWER 1]

If a function is real and continuos in the region from a to b and f(a) and f(b) and if both have different signs then there is atleast one real root between ~~and~~ a and b. This is because the function has to cross the x-axis atleast once.

Graphical example:

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



[ANSWER 2]

Here the equation is $x^3 - 2 \cdot x - 5 = 0$.

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

Now

x	0	1	2	3
$f(x)$	-5	-6	-1	16

1st iteration:

Here $f(2) = -1 < 0$ and $f(3) = 16 > 0$

$\therefore$ Root lies between 2 and 3

$$x_0 = \frac{2+3}{2} = 2.5$$

$$f(x_0) = f(2.5) = (2.5) \cdot 3 - 2 \cdot (2.5) - 5$$
$$= 5.625 > 0$$

2nd iteration:

Here $f(2) = -1 < 0$ and $f(2.5) = 5.625$

$\therefore$ Now root lies between 2 and 2.5

$$x_1 = \frac{2+2.5}{2} = 2.25$$

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$f(x_1) = f(2.125) = (2.125)^3 - 2.(2.125) - 5$

$= \cancel{0.3457 > 0}$

$= 1.89062 > 0$

3rd iteration :

Here $f(2) = 8 - 1 < 0$ and $f(2.25)$

$= 1.89062 > 0$

$\therefore$ Now root lies between 2 and 2.25

$$x_2 = \frac{2 + 2.25}{2} = 2.125$$

$f(x_2) = f(2.125) = (2.125)^3 - 2.(2.125) - 5$

$= 0.3457 > 0$

4th Iteration :

Here $f(2) = -1 < 0$ and $f(2.125) = 0.3457 > 0$

$\therefore$ Now root lies b/w 2 and 2.125

$$x_3 = \frac{2 + 2.125}{2} = 2.0625$$

$f(x_3) = f(2.0625) = (2.0625)^3 - 2.(2.0625)$

$- 5 = -0.35132 > 0$

So, the root of given equation upto 4 places of decimal is 2.0625.

[ANSWER 3]

Method of false Position.

An algorithm for finding roots which retains that prior extimates for which the function value has opposite sign from a function value at the current best estimates of the root. In this way, the method of false position keeps the root bracketed.

using the two-point form of the line.

$$y - y_1 = \frac{f(x_{n-1}) - f(x_1)}{x_{n-1} - x_1} (x_n - x_1)$$

with $y = 0$, using $y_1 = f(x_1)$, and solved for x_n, there fore gives the iteration

$$x_n = x_1 - \frac{x_{n-1} - x_1}{f(x_{n-1}) - f(x_1)} = f(x_1)$$