

# GRAPHICAL METHOD TO FIND REAL ROOT OF AN EQUATION

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# Introduction

- For any cartesian equation in one variable, the root of given equation is the point where graph intersects X-axis.
- Now if it is practically not easy to plot graph of given equation directly, for such equation we can split the given equation into two parts as follows.
- If given equation is  $f(x) = 0$ .
- We split function  $f$  into  $f_1$  and  $f_2$  such that,
- $f(x) = f_1(x) - f_2(x)$
- Now to find  $x$  such that  $f(x) = 0$ .
- We can find  $x$  such that  $f_1(x) = f_2(x)$ .

Method for solving equation by Graphical method.

**Step-1:** first find the appropriate range of  $x$  such that the root of given equation is lying in that range.

**Step-2:** for this selected range plot the graph of  $f_1$  &  $f_2$  using appropriate scale.

**Step-3:** find the approximate point on X-axis corresponding to the intersection of this two graphs.

That is your required solution.

Example-1 : find the root of an equation

$$f(x) = x^3 - 3x^2 - 3x + 1 = 0$$

using graphical method.

•Solution:

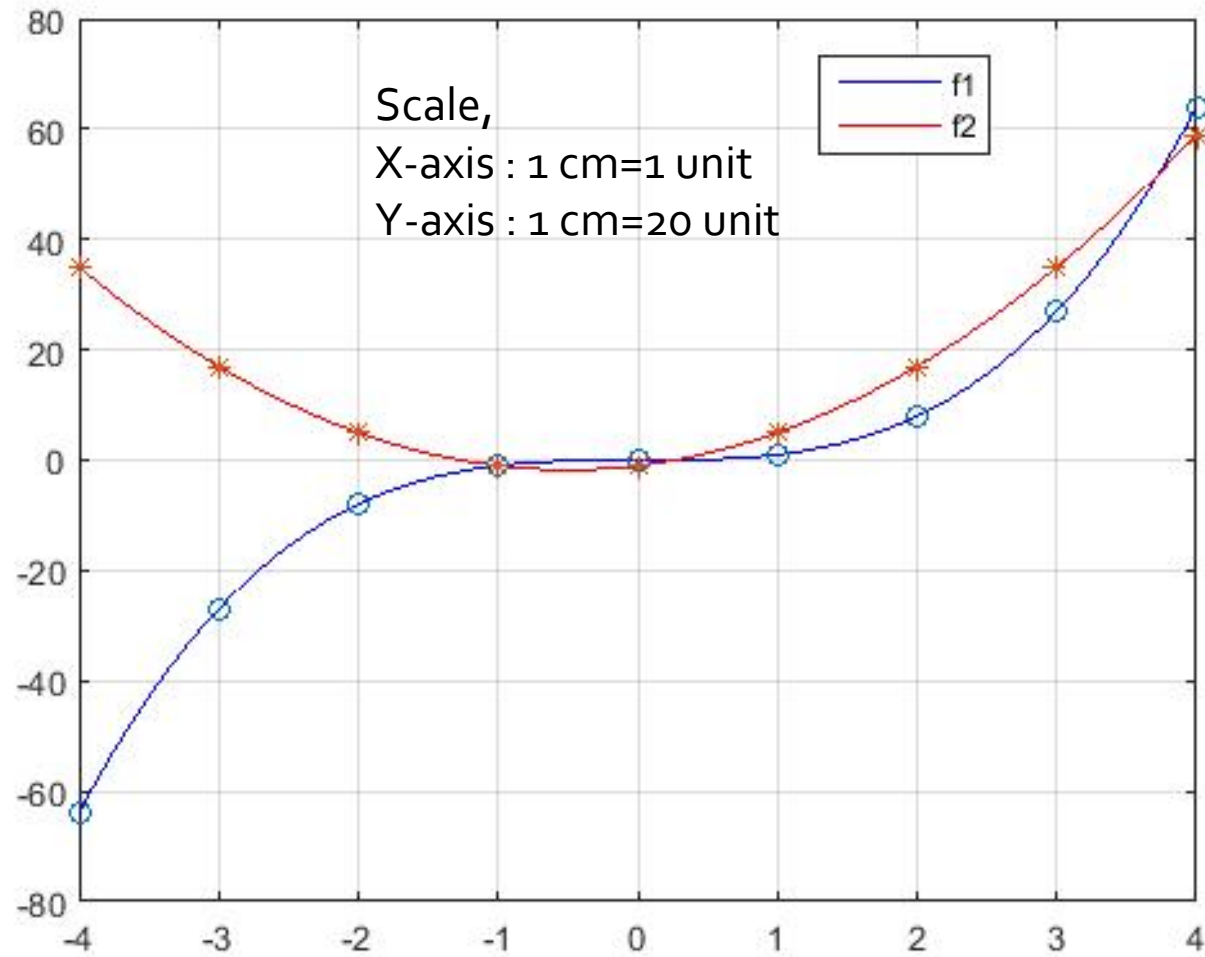
Here,  $f(x) = x^3 - 3x^2 - 3x + 1 = 0$

So  $f(x) = (x^3) - (3x^2 + 3x - 1) = 0$

Taking  $f_1(x) = x^3$  &  $f_2(x) = 3x^2 + 3x - 1$  now we want to find  $x$  such that  $f_1(x) = f_2(x)$ .

Taking appropriate values of  $x$  we have following table.

$x$	-4	-3	-2	-1	0	1	2	3	4
$f_1(x)$	-64	-27	-8	-1	0	1	8	27	64
$f_2(x)$	35	17	5	-1	-1	5	17	35	59



Required solution of given equation is  $x = -1$ .

Example-2 : find the root of an equation

$$f(x) = x^4 - 11x^2 + 2x + 1 = 0$$

using graphical method.

•Solution:

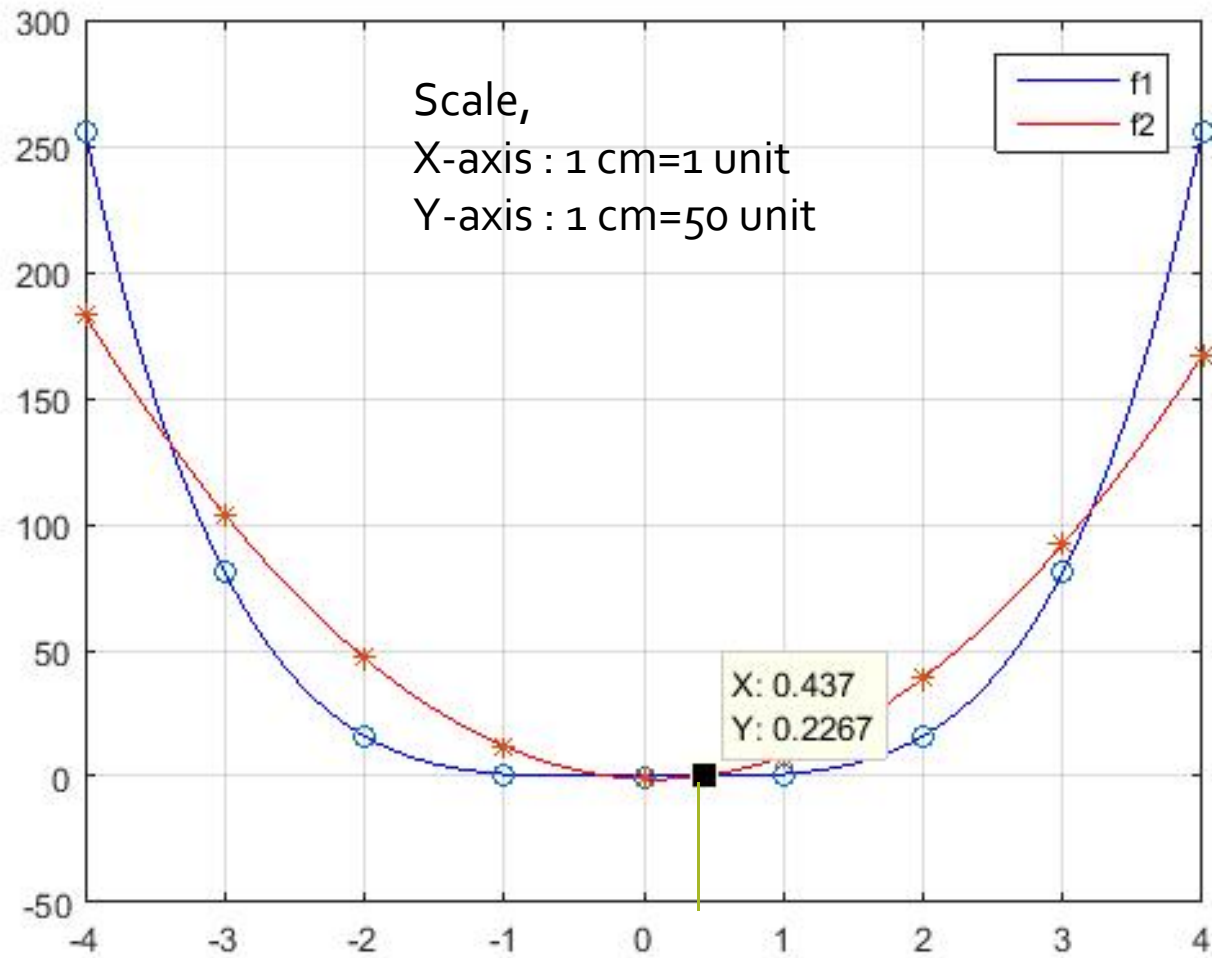
Here,  $f(x) = x^4 - 11x^2 + 2x + 1 = 0$

So  $f(x) = (x^4) - (11x^2 - 2x - 1) = 0$

Taking  $f_1(x) = x^4$  &  $f_2(x) = 11x^2 - 2x - 1$  now we want to find  $x$  such that  $f_1(x) = f_2(x)$ .

Taking appropriate values of  $x$  we have following table.

$x$	-4	-3	-2	-1	0	1	2	3	4
$f_1(x)$	256	81	16	1	0	1	16	81	256
$f_2(x)$	183	104	47	12	-1	8	39	92	167



Required solution of given equation is  $x = -1$ .

Example-3 : find the root of an equation

$$f(x) = e^x - \sin(x) = 0$$

using graphical method.

Example-4 : find the root of an equation

$$f(x) = x + \log x = 0$$

using graphical method.

Example-5 : find the root of an equation

$$f(x) = x^2 - \tan x = 0$$

using graphical method.



# THANK YOU

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