

# 10.4.ex.13.1

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**Problem:** Find the roots of the following quadratic equations, if they exist, using the quadratic formula: (i)  $3x^2 - 5x + 2 = 0$

**Solution:**

The roots can be found in multiple methods. We will solve the problem using the Newton-Raphson method, as it works well for our case due to simplicity.

**Newton-Raphson method:**

From a starting value  $x_0$ , we iterate as following:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad (0.1)$$

If the roots are real,  $x_n$  will converge to a root; but if the roots are complex and the coefficients are real,  $x_n$  will converge either to an extrema or grow boundlessly if our initial guess is not complex.

In our case,

$$\begin{aligned} f(x) &= 3x^2 - 5x + 2 \\ f'(x) &= 6x - 5 \end{aligned}$$

And the update equation will be

$$x_{n+1} = x_n - \frac{3x^2 - 5x + 2}{6x - 5} \quad (0.2)$$

Taking starting values of  $x$  as  $x = 10, -10$ , in 9 iterations each, we find the roots to be 0.666667 and 1.000000.

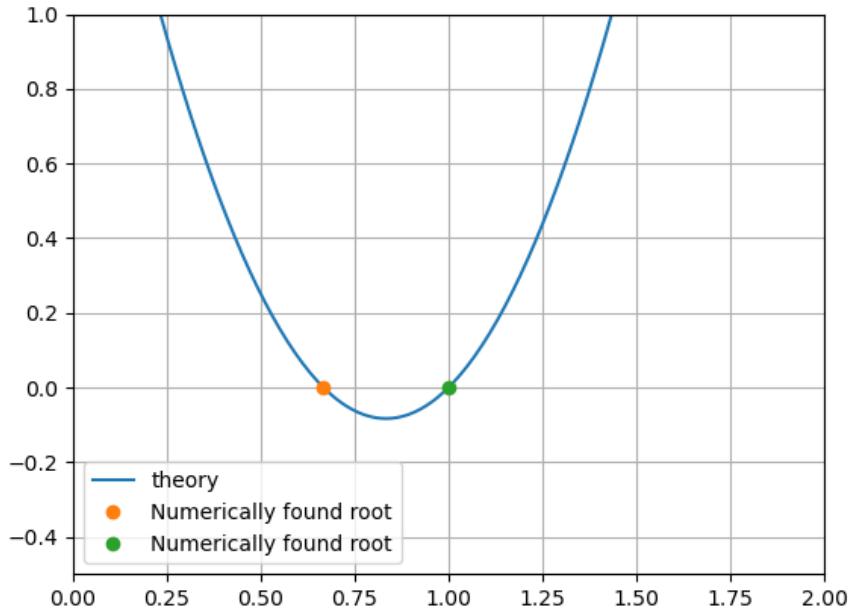


Fig. 0.1: Graphical verification