**Answer on Question #65700 – Math – Algorithms | Quantitative Methods**

**Question**

Using Xo = 0 find an approximation to one of the zeros of x^3 − 4x +1 = 0 by using Birge Vieta Method. Perform two iterations

**Solution**

$$f(x) = x^3 - 4x + 1,\ f'(x) = 3x^2 - 4,\ x_0 = 0,\ \ f(0) = 1,\ f'(0) = -4$$
$$f(x) = xQ(x) + R(x) = x(x^2 - 4) + 1,\ Q(x) = x^2 - 4,\ R(x) = 1$$

| | | | | |
|---|---|---|---|---|
| 0 | 1 | 0 | -4 | 1 |
| | 1 | 0+0*1=0 | -4+0*0=-4 | 1+0*(-4)=1=f(0) |
| | 1 | 0+0*1=0 | -4+0*0=-4= f'(0) | |

$\frac{f(x)}{x-x_0} = \frac{x^3-4x+1}{x} = x^2 - 4 + \frac{1}{x}, \quad x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0 - \frac{1}{-4} = 0.25.$

| | | | | |
|---|---|---|---|---|
| 0.25 | 1 | 0 | -4 | 1 |
| | 1 | 0+0.25=0.25 | -4+0.25*0.25=-3.9375 | 1+0.25*(-3.9375)=0.015625=f(0.25) |
| | 1 | 0.25+0.25*1=0.5 | -3.9375+0.25*0.5=-3.8125= f'(0.25) | |

$$f(x) = x^3 - 4x + 1,\ f'(x) = 3x^2 - 4,\ x_1 = 0.25,\ \ f(0.25) = 0.015625,$$
$$f'(0.25) = -3.8125$$
$$f(x) = xQ_1(x) + R_1(x) = (x - 0.25)(x^2 + 0.25x - 3.9375) + 0.015625,$$
$$Q_1(x) = x^2 + 0.25x - 3.9375,\ R_1(x) = 0.015625$$

$\frac{f(x)}{x-x_1} = \frac{x^3-4x+1}{x-0.25} = x^2 + \frac{x}{4} - \frac{63}{16} + \frac{\frac{1}{64}}{x-0.25},$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.25 - \frac{\frac{1}{64}}{-3.8125} = 0.2541.$$

**Answer:** 0.25; 0.2541.