Question #65623, Math / Other

The equation x^3 − x −1 = 0 has a positive root in the interval] 1,2[. Write a fixed point iteration method and show that it converges. Starting with initial approximation x0 = 1.5 find the root of the equation correct to three decimal places.

Answer.

$x_{n+1} = g(x_n)$

Let

$x_{n+1} = \sqrt[3]{x_n + 1}$.

$\frac{dg}{dx} = \frac{1}{3\sqrt[3]{(x+1)^2}}$, $\frac{dg}{dx} < 1 \ when\ x \in [1, 2]$.

So fixed point method converges.

x	g(x)
1.5	1.357209
1.357209	1.330861
1.330861	1.325884
1.325884	1.324939
1.324939	1.32476

Thus, the root is $x = 1.325$.

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