

J.M.S. Regula falsi method

work rule

Step I Given eqn $f(x) = 0$ — (1)

find x_0 and x_1 such that

$f(x_0) < 0$ & $f(x_1) > 0$

ie $f(x_0) \cdot f(x_1) < 0$

\Rightarrow Root of (1) lies b/w (x_0, x_1)

Step II find 1st approximate root by Regula falsi method

$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)}$ — (1)

find $f(x_2)$ and examine its sign.

Step 3 (3.1) If $f(x_2) < 0$ then replace.

$x_0 = x_2$ [if $f(x_2)$ is value (-) then $x_0 = x_2$ and approximate root]

(3.2) If $f(x_2) > 0$ then replace.

$x_1 = x_2$ [if $f(x_2)$ is value (+) then $x_1 = x_2$ and approximate root]

(3.3) find 2nd approximate root by

$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)}$

find $f(x_2)$ by Repeat Step 3 until the required accurate root.

Q. Find the real root of equation $x^3 - 4x - 9 = 0$ by Regula Falsi method correct upto 4 decimal place.

Sol: \rightarrow Let $f(x) = x^3 - 4x - 9 = 0$ ——— (1)

To find x_0 and $x_1 = f(1) = -12 < 0$

$f(2) = 8 - 8 - 9 = -9 < 0$ } middle

$f(3) = 27 - 12 - 9 = 6 > 0$ } both

$f(2.6) = -1.824 < 0$

$f(2.7) = -0.117 < 0$

$f(2.8) = 1.752 > 0$

choosing $x_0 = 2.7$ and $x_1 = 2.8$

$f(x_0) = -0.117, f(x_1) = 1.752$

First approximate root by Regula Falsi method

$$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)} = \frac{2.7 \cdot 1.752 - 2.8 \cdot (-0.117)}{1.752 - (-0.117)} = 2.706260$$

$f(x_2) = f(2.706260) = -0.004816 < 0$

choosing $x_0 = 2.706260, x_1 = 2.8$ no change

Again $f(x_0) = -0.004816, f(x_1) = 1.752$

2nd approximate root

$$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)} = \frac{2.706260 \cdot 1.752 - 2.8 \cdot (-0.004816)}{1.752 - (-0.004816)} = 2.706516$$

$f(x_2) = f(2.706516) = -0.000214 < 0$

choosing $x_0 = 2.706516, x_1 = 2.8$

$f(x_0) = -0.000214, f(x_1) = 1.752$

3rd approximate root

$$x_2 = \frac{x_0 f(x_1) - x_1 f(x_0)}{f(x_1) - f(x_0)} = \frac{2.706516 \cdot 1.752 - 2.8 \cdot (-0.000214)}{1.752 - (-0.000214)} = 2.706527$$

Here the approximate root correct to four decimal place is $x = 2.7065$