$\boxed{x_5 = 2.9431}$

Comparison x_5 & x_4 $= 2.943$

$\boxed{\text{final root} = 2.943}$

Regula

$\boxed{x_4 = 2.9427}$

Put x_4 in $f(x)$

$f(x) = x^3 - 9x + 1$

$f(x_4) = (2.9427)^3 - 9(2.9427) + 1$

$\boxed{f(x_4) = -2.038 \times 10^{-3}}$ $-ve$

$$x_5 = x_0 - \frac{(x_1 - x_0)}{f(x_1) - f(x_0)} \cdot f(x_0)$$

$\boxed{x_1 = 3}$ $\boxed{f(x_1) = 1}$

$\boxed{x_0 = 2.9427}$ $\boxed{f(x_0) = -2.038 \times 10^{-3}}$

$$x_5 = 2.9427 - \frac{(3 - 2.9427)}{(1 + 2.038 \times 10^{-3})} \cdot (-2.038 \times 10^{-3})$$

$$x_3 = 2.9 - \frac{(3-2.9)}{(1+0.711)} \cdot (-0.711)$$

$$\boxed{x_3 = 2.9415}$$

Put x_3 in $f(x)$

$f(x) = x^3 - 9x + 1$

$f(x_3) = (2.9415)^3 - 9(2.9415) + 1$

$\boxed{f(x_3) = -0.0223}$ $-ve$

$$x_4 = x_0 - \frac{(x_1 - x_0)}{f(x_1) - f(x_0)} \cdot f(x_0)$$

$\boxed{x_1 = 3}$ $\boxed{f(x_1) = 1}$ $\boxed{x_0 = 2.9415}$ $\boxed{f(x_0) = -0.0223}$

$$x_4 = 2.9415 - \frac{(3-2.9415)}{(1+0.0223)} \cdot (-0.0223)$$

Regula falsi method the root lies b/w 2 & 3.

$\boxed{x_4 = 2.9427}$

Put x_4 in $f(x)$

$f(x) = x^3 - 9x + 1$

$f(x_4) = (2.9427)^3 - 9(2.9427) + 1$

$\boxed{f(x_4) = -2.038 \times 10^{-3}}$ $-ve$

$$x_5 = x_0 - \frac{(x_1 - x_0)}{f(x_1) - f(x_0)} \cdot f(x_0)$$

$\boxed{x_1 = 3}$ $\boxed{f(x_1) = 1}$

$\boxed{x_0 = 2.9427}$ $\boxed{f(x_0) = -2.038 \times 10^{-3}}$

$$x_5 = 2.9427 - \frac{(3-2.9427)}{(1+2.038\times 10^{-3})} \cdot (-2.038\times 10^{-3})$$

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Que ① → find a root $f(x) = x^3 - 9x + 1 = 0$ by Regula falsi method the root lies b/w 2 & 3.

Sol^n ① → $f(x) = x^3 - 9x + 1 = 0$

$\boxed{x = 2} \rightarrow f(2) = 8 - 18 + 1 = -9 = -ve$

$\boxed{x = 3} \rightarrow f(3) = \cancel{27} - \cancel{27} + 1 = 1 = +ve$

$\boxed{x_0 = 2} \rightarrow \boxed{f(x_0) = -9}$

$\boxed{x_1 = 3} \rightarrow \boxed{f(x_1) = 1}$

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

$$x_2 = 2 - \frac{(3 - 2)}{1 + 9} \cdot (-9)$$

$$x_2 = 2 + \frac{1}{10} \times 9$$

$$x_2 = 2 + \frac{9}{10}$$

$$x_2 = 2 + 0.9$$

$$\boxed{x_2 = 2.9}$$

Put $x_2 = 2.9$ in $f(x)$

$f(x) = x^3 - 9x + 1$

$f(x_2) = (2.9)^3 - 9 \times 2.9 + 1$

$\boxed{f(x_2) = -0.711}$ $-ve$

$$x_3 = x_0 - \frac{(x_1 - x_0)}{f(x_1) - f(x_0)} \cdot f(x_0)$$

$\boxed{x_1 = 3}$ $\boxed{f(x_1) = 1}$ $\boxed{x_0 = 2.9}$ $\boxed{f(x_0) = -0.711}$

Second Approx. : Put $x_0 = 0.31466$ & $x_1 = 1$

$$x_3 = x_0 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} \cdot f(x_0)$$

$$= 0.44672$$

$$f(x_3) = -0.20354$$

A root lies betⁿ $\underbrace{0.44672}_{x_0}$ & $\underbrace{1}_{x_1}$.

Repeat the process, the successive approximations are

$x_4 = 0.49401$ $\quad$ $x_6 = 0.51520$ $\quad$ $x_8 = 0.51748$

$x_5 = 0.50995$ $\quad$ $x_7 = 0.51692$ $\quad$ $x_9 = 0.51767 \approx 0.5177$

$x_{10} = 0.51774 \approx 0.5177$

Problem 1. Find a root of the equation $xe^x = \cos x$ using the regula-falsi method correct to four decimal places.

$\frac{180}{\pi} = 57.3$

Sol.ⁿ Let $f(x) = xe^x - \cos x$

$f(0) = -1$, $f(1) = 1 \cdot e^1 - \cos(1 \times 57.3) = 2.179 = +ve$

Root lies betⁿ 0 and 1.

First approx.: ~~let~~ Put $x_0 = 0, x_1 = 1$

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

$$= 0 - \frac{1 - 0}{2.179 + 1} \cdot (-1) = 0.31466$$

The root lies betⁿ $\underset{x_0}{0.31466}$ and $\underset{x_1}{1}$.

$f(x_2) = (0.31466)e^{0.31466} - \cos(0.31466 \times 57.3) = -0.51988$

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

$f(x_2) = \underline{+ve}$

$\because$ $f(2) = -ve$ and $f(x_2) = +ve$,

the root lies b/w 2 and x_2

$$x_3 = \frac{(2)\, f(x_2) - x_2 f(2)}{f(x_2) - f(2)} = \underline{\qquad}$$

and repeat till desired accuracy is achieved.

REGULA - FALSI METHOD (or False - Position Method)

Let $f(x) = 0$ be the given eq.^{n}

Suppose, $f(0) = -ve$

$f(1) = -ve$

$f(2) = -ve$

$f(3) = +ve$

$\because$ $f(2) = -ve$ and $f(3) = +ve$,

the root lies between 2 and 3.

Let $x_0 = 2$ and $x_1 = 3$

$\therefore$ $f(x_0) = -ve$ and $f(x_1) = +ve$.