Assignment-04
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Answer to the question no-1

a) $f(x) = x^3+x^2-4x-4$

$\Rightarrow f(x) = 0$

$\Rightarrow x^3+x^2-4x-4=0$

Now, $x^2(x+1)-4(x+1)=0$

$\therefore x = -2,-1,2$

Again,

$x^3+x^2-4x-4=0$

$\Rightarrow 4x = x^3+x^2-4$

$\therefore x = \frac{x^3+x^2-4}{4}$

$\therefore g_1(x) = \frac{x^3+x^2-4}{4}$

And,

$x^3+x^2-4x-4=0$

$\Rightarrow x = x^3+x^2-3x-4$

$\therefore g_2(x) = x^3+x^2-3x-4$

(Ans)

b) from (a),

$$g_1(x) = \frac{x^3+x^2-4}{4}$$ and, $x_* = -2, -1, 2$

$$g_2(x) = x^3+x^2-3x-4$$

Now,

~~$g_1'(x) =$~~

Convervence rate for g_1,

$\lambda = |g_1'(x_*)|$

$\therefore |g_1'(-2)| = 2 > 1$; divergence

$|g_1'(-1)| = 0.25 < 1$; convergence

$|g_1'(2)| = 4 > 1$; divergence

for g_2,

$\lambda = |g_2'(x_*)|$

$|g_2'(-2)| = 5 > 1$; divergence

$|g_2'(-1)| = |-2| = 2 > 1$; divergence

$|g_2'(2)| = 13 > 1$; divergence

(Ans)

Answer to the question no-2

a) $f(x) = xe^{x} - 1$; $x_0 = 1.5$

$i = 0$; $x_0 = 1.5$

$i = 1$; $x_1 = x_0 - \dfrac{f(x_0)}{f'(x_0)}$

$$= 1.5 - \frac{f(1.5)}{f'(1.5)}$$

$$= 1.5 - \frac{5.7225}{11.20}$$

$$\Rightarrow x_1 = 0.9890$$

$i = 2$; $x_2 = 0.9890 - \dfrac{f(0.9890)}{f'(0.9890)}$

$$= 0.6787$$

$i = 3$; $x_3 = 0.5765$

$i = 4$; $x_4 = 0.5672$

$i = 5$; $x_5 = 0.5671$

$\therefore x_n = 0.5671$

(Ans)

b) $g(x) = (9x-1)^{1/3}$

$$g'(x) = \frac{9}{3(9x-1)^{2/3}}$$

As $g(x)$ leads to divergece:

$$\lambda = |g'(x)| > 1$$

$$\Rightarrow \left| \frac{9}{3(9x-1)^{2/3}} \right| > 1$$

$$\Rightarrow \left| \frac{1}{(9x-1)^{2/3}} \right| > \frac{1}{3}$$

$$\Rightarrow \left| (9x-1)^{2/3} \right| > 3$$

$$\Rightarrow |9x-1| > \sqrt[2/3]{3}$$

$$\Rightarrow |9x-1| > 5.1962$$

$$\Rightarrow 9x-1 > \pm 5.1962$$

$$\Rightarrow -5.1962 < 9x-1 < 5.1962$$

$$\Rightarrow -4.1962 < 9x < 6.1962$$

$$\therefore -0.46622 < x < 0.68847$$

(Ans)

Answer to the question no-3

a) $f(x) = 2x^3 - 2x - 5$

According to NR method;

$$x_{k+1} = x_k - \frac{f(x_k)}{f'(x_k)}$$

So, $g(x) = x - \frac{f(x)}{f'(x)}$

Now,

$$f'(x) = 6x^2 - 2$$

$$\therefore g(x) = x - \frac{2x^3 - 2x - 5}{6x^2 - 2}$$

(Ans)