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Q1) $R_W = 12.65$ $R_C = 12.5$

Absolute error = | Actual value − Measure value |

$= |12.5 - 12.65|$

$= 0.15$

Relative Error $\frac{\text{Measu} - \text{Actual}}{\text{Actual}} = \frac{12.65 - 12.5}{12.5} = 0.012$

% Error $= 0.012 \times 100 = 1.2\%$

Q2) $f(x) = \log x$

4.0 =	0.60206
4.5	0.6532125
5.5	0.7403627
6.0	0.7781513

a) $\log(5)$ let $\log(5)$ be y

$y = 0.60206 + \frac{1}{2}(0.7781513 - 0.60206)$

$= 0.690105$

b) $\log(5) = z$

$z = 0.6531225 + \frac{1}{2}(0.7403627 - 0.6532125)$

$= 0.6967876$

Q3) Root of eq^n $x^4 - x - 10$ upto 5 iteration

$a = 1.5$

$b = 2$

x	y
1.5	−6.4375
2	4

$x_1 = \frac{1.5 + 2}{2} = 7/4$ $y_1 = -2.37109375$

$x_2 = \frac{1.75 + 2}{2} = 1.875$ $y_2 = 0.4846191$

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$x_3 = \frac{1.75 + 1.875}{2} = 1.8125$ $y_3 = -1.0202484413$

$x_4 = \frac{1.8125 + 1.875}{2} = 1.84375$ $y_4 = 0.2877346$

$x_5 = \frac{1.84375 + 1.875}{2} = 1.859375$ $y_5 = 0.0973781266$

Q4) $f(x) = x^3 - x - 1$ using Newton Raphson Method

x	$f(x)$
0	-1
1	-1
2	5

$f'(x) = 3x^2 - 1$

$x_0 = 1$

$f(x_0) = -1$ $f'(x_0) = 2$

$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 1.5$

$y_1 = 0.875$ $f'(x_1) = 5.75$

$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 1.347826$

$y_2 = 0.100681$

$f'(x_2) = 0.449904$

$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 1.3252$

$y_3 = 0.0020506$

$f'(x_3) = 4.268405$

$x_4 = x_3 - \frac{f(x_3)}{f'(x_3)} = 1.324718$

$y_4 = 0.0\cancel{00000}6087$

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Q5) Given $A^2 = A$

$7A - (I+A)^3 \Rightarrow 7A - (I^3 + A^3 + 3IA + 3A^2)$

$= -1$

Q6) $A = \begin{bmatrix} 1 & -1 & 2 \\ 4 & 0 & 6 \\ 0 & 1 & -1 \end{bmatrix}$ To find A^{-1}

$|A| = 1(-1(0) - 6(1)) + (-4-0) + 2(4)$
$= -2$

Adj of A $\begin{bmatrix} -6 & 4 & 4 \\ 1 & -1 & -1 \\ -6 & 1 & 4 \end{bmatrix} = \begin{bmatrix} -6 & 1 & -6 \\ 4 & -1 & 1 \\ 4 & -1 & 4 \end{bmatrix}$

$A^{-1} = \frac{\text{adj } A}{|A|} = \begin{bmatrix} 3 & -1/2 & 3 \\ -2 & +1/2 & -1 \\ -2 & -1/2 & -2 \end{bmatrix}$

Q7) $A = 8i - 9j$
$B = 7i - 9j$

$|\vec{a}| = \sqrt{64+72} = 2\sqrt{34}$

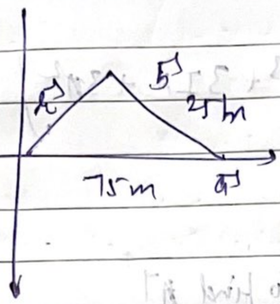
$|\vec{b}| = \sqrt{49+81} = \sqrt{130}$

$\cos\theta = \frac{(8i-9j)(7i-9j)}{2\sqrt{34} \times \sqrt{130}}$

$\frac{56+81}{2\sqrt{34 \times 130}} = \frac{137}{2\sqrt{34 \times 130}} = C$

$\theta = \cos^{-1}\left(\frac{137}{2\sqrt{4420}}\right)$

Q8)



$\vec{R} = \vec{a} + \vec{b}$

$= |\vec{a}|^2 + |\vec{b}|^2 + 2\vec{a}\vec{b}$

$= 75^2 + 25^2 + 2(75)(25)\frac{\sqrt{3}}{2}$

$\vec{R}^2 = 9497.5952\ m$

$\vec{R} = 97.46\ m$

Q9)

$a = 101$

$a_n = 998$ $\quad a_n = a + (n-1)d$

$d = 3$ $\quad = 101 + (n-1)3$

$\boxed{n = 300}$

$S_n = \frac{n}{2}(a + a_n) = \frac{300}{2}(101 + 998)$

$= 164850$

Q10)

$ar^5 = 32$ $\quad \frac{ar^7}{ar^5} = \frac{128}{32}$ $\quad r = 2$

$ar^7 = 128$

Q11)

$f(x) = (4+3x)^5$

Using binomial th

${}^5C_0 (3x)^5 + {}^5C_1 (3x)^4(4)^1 + {}^5C_2 (3x)^3(4)^2 + {}^5C_3 (3x)^2(4)^3 + {}^5C_4 (3x)(4)^4$
$+ {}^5C_5 (4)^5$

$= 243x^5 + 1620x^4 + 4320x^3 + 7560x^2 + 3840x + 1024$

Q12)

$A = \begin{bmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ $\quad$ We know $|A - \lambda| = 0$

$$\begin{bmatrix} 2-\lambda & -3 & 0 \\ 2 & 5-\lambda & 0 \\ 0 & 0 & 3-\lambda \end{bmatrix} = 0$$

$$-(2-\lambda)(5+7)(3-\lambda) - (-3)\left((3-\lambda)(2) - 0\right) = 0$$

$$(-2+\lambda)(15-\lambda^2-2\lambda) + 3(6-2\lambda)$$

$$(-30 - 2\lambda^2 + 4\lambda + 15\lambda - \lambda^3 - 2\lambda^2) + (18-6\lambda)$$

$$\lambda^3 - 13\lambda + 12 = 0$$

if $\lambda = 1$

$$1^3 - 13 + 12$$
$$= 0$$

$\lambda = 1$ is one of root

1	1	0	-13	12
		1	1	-12
	1	1	-12	0

$$\lambda^2 + \lambda - 12 = 0$$
$$\lambda^2 + 4\lambda - 3\lambda - 12 = 0$$
$$(\lambda+4)(\lambda-3) = 0$$

eigen values $-4, 3$

Q13) $f(x) = x^3 - 7x^2 + 8x - 3$ if $x_0 = 5$

$x_0 = 5$

$f(x_0) = -13$ $f'(x_0) = 13$

$$x_1 = 5 - \frac{(-13)}{13} = 6$$

$f(x_1) = 9$ $f'(x_1) = 32$

$$x_2 = 6 - \frac{9}{32} = 5.71875$$

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Q14) Expand $= (1-x+x^2)^4$

let $1-x = y$

$\therefore (y+x^2)^4$

Using binom theorem

$^4C_0\, y^4 + {}^4C_1\, y^3 (x^2) + {}^4C_2\, y^2 (x^2)^2 + {}^4C_3\, y^1 (x^2)^3 + {}^4C_4 (x^2)^4$

$y^4 + 4y^3x^2 + 6y^2x^4 + 4yx^6 + x^8$

$(1-x)^4 + 4(1-x)^3(x^2) + 6x^4(1-x)^2 + 4x^6(1-x) + x^8$

$(1-x)^2(1-x)^2 + 4x^2(1-x^3-3x+3x^2) + 6x^4(1+x^2-2x) + 4x^6 - 4x^7 + x^8$

$1-4x+10x^2-16x^3+19x^4-16x^5+10x^6-4x^7+x^8$

Q15) $e^{-x} = 3\log x$ for value of x upto 4 iterations

$e^{-x} - 3\log(x) = 0$

x	y
0.5	1.510962
1	0.36787
1.5	-0.305143

$x_1 = \frac{1+1.5}{2} = 1.25$

$y_1 = -0.0042252$

$x_2 = \left(\frac{1+1.25}{2}\right) = 1.125$

$y_2 = 0.1711949$

$x_3 = \frac{1.125+1.25}{2} = 1.1875$

$y_3 = 0.0810819$

$x_4 = \frac{1.1875+1.25}{2} = 1.21875$

$y_4 = 0.0378555$