Date

ASSIGNMENT

Ques 1

Actual length = 12.5 cm = r_1 Approx radius taken = 12.65

Actual area = πr_1^2
= $\pi(12.5)^2$
= 490.8738521

wrong Area = $\pi(r_2)^2$
= $\pi(12.65)^2$
= 502.7255104

1 Absolute error = wrong - Actual
= 502.7255104 - 490.8738521
= 11.85165830

2 Relative error = $\frac{\text{Absolute error}}{\text{Actual area}}$

= $\frac{11.85165830}{490.8738521}$

= 0.024144

3 Percentage error = Relative error x 100
= 2.4144 %

Date

Ques 2 =>

USING INTERPOLATION

(i)

$X = 4 \longrightarrow 0.60206$
$X = 6 \longrightarrow 0.7781513$

$2 \longrightarrow 0.1760913$
$1 \longrightarrow \frac{0.1760913}{2}$

$5 \longrightarrow \frac{5}{2} \times 0.1760913$

$X = 5 \Rightarrow = 0.44022825$

(ii)

$X = 4.5 \longrightarrow 0.6532125$
$X = 5.5 \longrightarrow 0.7403627$

$1 \longrightarrow 0.0871502$
$5 \longrightarrow 0.435751$

$\boxed{X = 5 \longrightarrow 0.435751}$

Date

Ques 5 →

$$x^4 - x - 10 = 0$$

x	y
1.5	-6.4375
2	4

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

$$= 1.75$$

$x_1 = 1.75$ $\quad y_1 = -2.371093750$

$x = 2$ $\quad 4$

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

$$y_2 = 0.486191$$

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

$$y_3 = -1.0202$$

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

$$y_3 = -0.28773$$

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

$$y_5 = 0.0933$$

x_5 for curbin $= 1.859375$

#

Date

Ques 4

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

x	y	
0	-1	$-ve$
2	$8-2-1 = 5$	$+ve$

Formula

$$x_{New} = x_{old} - \frac{f(x_{old})}{f'(x_{old})}$$

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

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

Let $x = 0$

$f(0) = -1$

$f'(0) = -1$

$$x_1 = 0 - \left[\frac{-1}{-1}\right]$$

$x_1 = -1$

$f(x_1) = -1 - (-1) - 1$

$= -1 + 1 - 1 = -1$

$f'(x_1) = 3 - 1 = 2$

$$x_2 = -1 - \left[\frac{-1}{2}\right]$$

$$= -1 + \frac{1}{2} = -1 + 0.5 = -0.5$$

$x_2 = -0.5$

$f(x_2) = -0.625$

$f'(x_2) = -0.25$

#

Date

$$x_3 = -0.5 - \left[\frac{+0.625}{+0.25}\right]$$

$$= -0.5 - [2.5]$$

$$= -3$$

$$x_4 = -3 + \left[\frac{+25}{26}\right]$$

$$= -2.038461538$$

$f(x_4) = -7.432009558$

$f'(x_4) = 11.46597633$

$$x_5 = -2.038461538 + \frac{7.432009558}{11.46597633}$$

$x_5 = -1.390282145$

$f(x_5) = -2.296972584$

$f'(x_5) = 4.798653328$

$$x_6 = -1.390282145 - \left(\frac{f(x_5)}{f'(x_5)}\right)$$

$x_6 = -0.9116118958$

$f(x_6) = -0.845970634 3$

$f'(x_6) = 1.493108746$

$x_7 = -0.345028$

$f(x_7) = 0.00060456.$

Date

Ques 5 $A^2 = A$ $\quad (a+b)^3 = a^3+b^3+3ab(a+b)$

$$7A - (I+A)^3$$
$$7A - [I+A^3+3A(1+A)]$$
$$7A - [I+A^2A+3A+3A^2]$$
$$7A - [I+A+3A+3A]$$
$$7A - 7A - I = -I$$

Ques 6 ⇒

$$\begin{bmatrix} 1 & -1 & 2 \\ 4 & 0 & 6 \\ 0 & 1 & -1 \end{bmatrix} \quad a_{12}$$

$(-2) = -1$

-1

$$|A| = 1(0-6)+1(-4)+2(4)$$
$$= -6-1+8$$
$$= 0$$

6 -8

-2

-4

$$|A| = 1(-6)+1(-4)+2(4)$$
$$= -6-4+8$$
$$= -2$$

$$(\text{adj}|A|) = \begin{bmatrix} -6 & 4 & +4 \\ 1 & -1 & -1 \\ -6 & 2 & -4 \end{bmatrix}$$

$$(\text{adj}\,A)^T = \begin{bmatrix} -6 & 1 & -6 \\ 4 & -1 & 2 \\ 4 & -1 & -4 \end{bmatrix}$$

$$A^{-1} = \frac{(\text{adj}\,A)^T}{|A|} = -\frac{1}{2}\begin{bmatrix} -6 & 1 & -6 \\ 4 & -1 & 2 \\ 4 & -1 & -4 \end{bmatrix}$$

Date

Ques7 $\vec{a} = 8\hat{i} - 9\hat{j}$ $\vec{b} = 7\hat{i} - 9\hat{j}$

$\vec{a} \cdot \vec{b} = (8\hat{i} - 9\hat{j}) \cdot (7\hat{i} - 9\hat{j})$

$= 56 + 81$

$= 137$

56
81
137

$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$

$137 = \sqrt{64+81}\sqrt{49+81}\cos\theta$

$0.997849458 = \cos\theta$

$3.758556^\circ = \theta$

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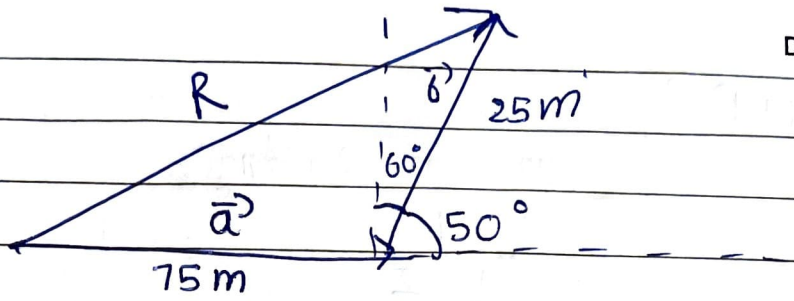
Ques 8 ⇒



Displacement vector = $\vec{R}$

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

$R^2 = A^2 + B^2 + 2AB\cos\theta$

$\theta = 30°$

$R^2 = 75^2 + 25^2 + 2(75)(25)\cos 30°$

$R^2 = 9497.595264$

$R = 97.4556$ metres

Thus displacement = 97.4556 metres

Ques 9 ⇒ Common difference, $d = 3$

AP = 101, 104, 107, - - - - - , 998

$a = 101$

$a_n = a + (n-1)d$

$998 = 101 + (n-1)3$

$300 = n$

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

$= 150(101 + 998) = 1,64,850$

Ques 10 ⇒

$a_6 = 32$

$ar^5 = 32$

$a_8 = 128$

$ar^7 = 128$

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

$r = 2$ or -2, rejected as given negative values.

Date

Ques 11 $(3x+4)^5$

Using pascal triangle

1
1 2
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

$(3x+4)^5 = (3x)^5 + (5 \times 4 \times (3x)^4) + (10 \times (3x)^3 \times 4^2) + (10 \times (3x^2) \times 4^3) + (5 \times 3x \times 4^4) + 4^5$

$= 243x^5 + 1620x^4 + 4320x^3 + 5760x^2 + 3840x + 1024$

Ques 12 $\Rightarrow$

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

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

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

$|A - \lambda I| = (3-\lambda)[(2-\lambda)(-5-\lambda) + 6]$

$= (3-\lambda)[-10 - 2\lambda + 5\lambda + \lambda^2 + 6]$

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

$= 3\lambda^2 + 9\lambda - 12 - \lambda^3 - 3\lambda^2 + 4\lambda$

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

Date

By using hit and trial method
1 is the root of equation

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

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

Eigen values = $-4, 1$ and 3

Ques 13

$f(x) = x^3 - 7x^2 + 8x - 3$
$f'(x) = 3x^2 - 14x + 8$
$x_0 = 5$
$f(5) = -13$
$f'(5) = 13$

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 5 - \left(\frac{13}{-13}\right) = 6$$

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

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 6 - \frac{9}{32} = 5.71875$$

$f'(x_2) = 0.84787$

Date

Ques 14

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

Using Pascal's triangle

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1

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

Ques 15

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

x	y
0.6	-0.11673
0.7	0.03188

$x_0 = 0.6$, $y_0 = -0.11673$

$x_1 = 0.7$, $y_1 = 0.03188$

1 $x_2 = \frac{x_0+x_1}{2} = 0.65$

$y_2 = -0.03921$

2 $x_3 = \frac{x_2+x_1}{2} = 0.675$

$y_3 = -0.00293$

#

Date

3 $x_4 = \frac{x_3 + x_1}{2} = 0.6875$

$y_4 = 0.01465$

4 $x_5 = \frac{x_4 + x_5}{2} = 0.68125$

$y_5 = \underline{0.0059}$