Page No.
Date :

Numerical Methods & Algebra
Assignment

9| i) $A = \pi r^2$

$A = \pi \times (12.5)^2$ (Actual value)
$A = \pi \times (12.65)^2$ (Changed value

Change in Area $= 160.0225\pi - 156.25\pi$
$= 3.7725 \pi cm^2$

Absolute Error = Actual Value - Approx Value

$= 3.7725\pi - 3.7\pi$

$= 0.0225\pi \; cm^2$

Page No.
Date :

i) Relative Error

$$= \frac{\text{Actual value} - \text{Approximate value}}{\text{Actual value}}$$

$$= \frac{3.772\pi - 3.75\pi}{3.7725\pi}$$

$$= \frac{0.0225\pi}{3.7725\pi}$$

$= 0.006 cm^2$

ii) Percentage error

0.006×100

$= 0.6\%$

PAGE NO.

DATE. / /

Q2 a) Linear Interpolation

$$f(5) = f(4) + \frac{f(6) - f(4)}{6-4}(6-4)$$

$$f(5) = 0.60206 + \frac{0.778151 - 0.60206}{6-4}(5-4)$$

$$= 0.690106$$

$$\text{error} = \frac{0.69897 - 0.690106}{0.6987} \times 100\%$$

$$= 1.27\%$$

b) $$f(5) = f(4.5) + \frac{f(5.5) - f(4.5)}{5.5-4.5}(5-4.5)$$

$$f(5) = 0.653212 + \frac{0.740362 - 0.653212}{5.5-4.5}(5-4.5)$$

$$= 0.69877$$

$$\text{error} = \frac{0.69877 - 0.696788}{0.69877} \times 100\%$$

$$= 0.3\%$$

Q3 Iteration table is given as follows

No.	a	b	c	f(a)*f(c)
1	1.5	2	1.75	15.264
2	1.75	2	1.875	2.419
3	1.75	1.875	1.812	2.419
4	1.812	1.875	1.844	-0.303
5	1.844	1.875	1.86	-0.02

Solving the eqn = 1.86

Q4 $f(x) = x^3 + x - 1$
$f'(x) = 3x^2 + 1$

$x = (-1) \rightarrow f(-1) = (-3)$
$x = 0 - f(0) = (-1)$
$x = +1 \rightarrow f(1) - 1$

this indicate root occurs between (1, 0)

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

$x_0 = 1$ initial approx

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$x_{n+1} = x_n - \frac{(x^3 + x - 1)}{(3x^2 + 1)}$$

$$x_1 = x_0 - \frac{(x^3 + x - 1)}{(3x^2 + 1)}$$

$x_5 = 0.682278$

Q3 $7A-(I+A)^3$

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

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

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

$= 7A-(I-A-A+3A+3A)$

$= 7A-(I-AA+6A)$

$= 7A-(I+A^2+6A)$

$= 7A-(I+A+6A)$

$= 7A-(I+7A)$

$= -I$

$\therefore 7A-(I+A^3) = -I$

Q6 Inverse of $\begin{bmatrix} 1 & -1 & 2 \\ 4 & 0 & 6 \\ 0 & 1 & -1 \end{bmatrix}$

$$= \begin{bmatrix} 3 & -1/2 & 3 \\ -2 & 1/2 & -1 \\ -2 & 1/2 & -2 \end{bmatrix}$$

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

$$\theta = \cos^{-1}\left(\frac{A \cdot B}{|A|\,|B|}\right)$$

$$\theta = \cos^{-1}\left[\frac{(8i - 9j)\cdot(7i - 9j)}{(8i - 9j)(7i - 9j)}\right]$$

$$= \cos^{-1}\left[\frac{(8)(7) + (-9)(9)}{\sqrt{8^2 + (-9)^2}\,\sqrt{(7)^2 + (-9)^2}}\right]$$

$\theta = 3\cancel{0}7 6$

Q8 $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

$= \sqrt{75^2 + 25^2 + 2(75)(25)\cos 30}$

$= 97.46$ m

Q9 AP $= 101, 104, 107 \ldots 999$

$= 164,850$

PAGE NO.............

DATE. ..../........../........

Q10 6^{th} term = 32
8^{th} term = 128

$a_n = ar^{n-1}$

$ar^5 = 32$ eq^n (I)

$ar^7 = 128$ eq^n ii

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

$r^2 = 4$

$r = 2$

$\therefore r = 2$

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

$$(x+y)^n = x^n + n x^{n-1} y + \frac{n(n-1)}{2} x^{n-2} y^2$$

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

Q12 $\begin{pmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 6 \end{pmatrix}$

PAGE NO.
DATE. ..../..../....

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

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$f'(x) = 3x^2 - 14x + 8$$

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

$$= 5 - \frac{f(5)}{f'(5)}$$

$$= 5 - \frac{-13}{13}$$

$$= 6$$

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

$$= 6 - \frac{f(6)}{f'(6)}$$

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

$$= 5.71875$$

$$\therefore x_2 = 5.71875$$

PAGE NO.
DATE

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

Let $1-x = y$

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

$= {}^4C_0 y^4 (x^2)^0 + {}^4C_1 y^3 (x^2)^1 + {}^4C_2 y^2 (x^2)^2$
$+ {}^4C_3 y (x^2)^3 + {}^4C_4 (x^2)^4$

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

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

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

Q5) $e^{-x} = 3\log(x)$

No	a	b	c	fa * fb
1	0.5	1.5	1	0.555
2	1	1.5	1.25	$-1.555 \times 10^{-}$
3	1	1.25	1.125	0.063
4	1.125	1.25	1.187	0.44

$x = 1.187$