Pranav Vaswani
FYBs C
Roll number: 93

Page No.
Date: / /

NMA ASSIGNMENT

1) Observed Radius = 12.65cm
Actual radius = 12.5cm

Observed area $= \pi r^2$

$A_o = \pi (12.65)^2$

$\therefore A_o = 502.725 cm^2$

Actual Area $= \pi r^2$

$A_A = \pi \times (12.5)^2$

$A_A = 490.874 cm^2$

(i) Absolute error = Observed value − Actual value

$= 502.725 - 490.874$

$= 11.857 cm^2$

(ii) Relative error $= \dfrac{\text{Absolute error}}{\text{Actual value}}$

$= \dfrac{11.857}{490.874}$

$= 0.02414$

(iii) Percentage of error $= \cancel{\dfrac{\text{Absolute error}}{\text{Actual value}}}$ Relative Error $\times 100$

$= \cancel{11.857}$

$= 2.414\%$

2) (i) $x_1 = 4$ $\quad y_1 = 0.60206$

$x = 5$ $\quad y = ?$

$x_2 = 6$ $\quad y_2 = 0.7781513$

$$y_2 = \frac{y_2(x - x_1) + y_1(x_2 - x)}{(x_2 - x_1)}$$

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

$y = 0.6901$

$x^4 - x - 10 = 0$

$a = 1.5 \quad b = 2$

$f(a) = f(1.5) = (1.5)^4 - 1.5 - 10$

$= -6.43 75$

$f(b) = f(2) = 2^4 - 2 - 10$

$= 4$

1st iteration

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

$= 1.75$

$f(x_1) = f(1.75) = 1.75^4 - 1.75 - 10$

$= -2.3711$

2nd iteration

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

$f(x_2) = 1.875^4 - 1.875 - 10$

$= 0.4848$

3rd iteration

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

$f(x_3) = f(1.8125)$

$= 1.8125^4 - 1.8125 - 10$

$= -1.0202$

4th iteration

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

$= 1.84375$

$f(x_4) = f(1.84375)$

$= 1.84375^4 - 1.84375 - 10$

$= -0.2877$

Date: / /

5th iteration

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

$$= 1.859375$$

$$f(x_5) = 1.859375^4 - 1.859375 - 10$$

$$= 0.092$$

$\therefore$ Root of $x^4 - x - 10 = 10$ is 1.859375 which $\approx$ 1.86 'r.

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

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

x	0	1	2
y	-1	-1	5

$\therefore x_0 = \frac{1+2}{2} = 1.5$

$f(x_0) = 0.875$ $\quad f'(x_0) = 5.75$

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

$$1.5 - \frac{0.875}{5.75} = 1.34783$$

$f(x_1) = 0.10068$ $\quad f'(x_1) = 4.44991$

$$x_2 = 1.34783 - \frac{0.10068}{4.44991}$$

$$= 1.3252$$

$f(x_2) = 0.00205$

$f'(x_2) = 4.2684$

$$x_3 = 1.3252 - \frac{0.00205}{4.2684}$$

$$x_3 = 1.3247$$

$f(x_3) = 0.0000007545$

$f'(x_3) = 4.2645$

$x_4 = 1.3247 - \frac{0}{4.2645}$

$x_4 = 1.3247$

Root of $x^3 - x - 1 = 0$

is 1.3247

$A^2 = A$

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

$= 7A - I^3 - A^2 A - 3A^2 - 3A$

$= 7A - I - A.A - 3A - 3A$

$= 7A - I - A - 6A$

$= 7A - 7A - I$

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

Let $A = \begin{bmatrix} 1 & -1 & 2 \\ 4 & 0 & 6 \\ 0 & 1 & -1 \end{bmatrix}$

$|A| = 1 \begin{vmatrix} 0 & 6 \\ 1 & -1 \end{vmatrix} + 1 \begin{vmatrix} 4 & 6 \\ 0 & -1 \end{vmatrix} + 2 \begin{vmatrix} 4 & 6 \\ 0 & -1 \end{vmatrix}$

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

$|A| \neq 0 \therefore$ inverse exists

co-factor matrix $= \begin{vmatrix} -6 & 4 & 4 \\ 1 & -1 & 1 \\ -6 & 1 & 4 \end{vmatrix}$

$\therefore$ Adjoint matrix $= \begin{vmatrix} -6 & 1 & -6 \\ 4 & -1 & 2 \\ 4 & 1 & 4 \end{vmatrix}$

Page No.

Date : / /

$$\therefore A^{-1} = \frac{1}{|A|} \times \text{Adjoint}$$

$$-\frac{1}{2}\begin{bmatrix} -6 & 1 & -6 \\ 4 & -1 & 2 \\ 4 & 1 & 4 \end{bmatrix}$$

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

9) The smallest 3 digit number that leaves remainder of 2 is 101 and the largest = 998

$d = 3$

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

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

$n - 1 = \frac{998 - 101}{3}$

$n = 299 + 1$

$n = 300$

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

$S_n = 164850$

Sum of all number that leave a remainder of 2 when divided by 2 is 164850.

Date : / /

10) $t_6 = 32$

$t_8 = 128$

$t_6 = ar^5$

$t_8 = ar^4$

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

$\cancel{\Rightarrow}\ r^2 = 4$

$\boxed{r = 2}$

11) Expand $(4 + 3x)^5 = (3x + 4)^5$

$(a+b)^n = a^n + na^{n-1}b + n(n-1)\, a^{n-2}b^2$

$+ \frac{n(n-1)(n-1)}{3!} a^{x-3} b^3$

$= 243x^5 + 1625x^4 + 4320x^3 + 5160x^2$

$+ 3840x + 1024$

14) $(1 - x + x^2)^4$

$\therefore (x^2 + (1 + x))^4$

Let $1 - x = y$

$(x^2 + y)^4$

Using binomial theorem

$(a+b)^2 = a^n + (na)^{n-1} b + \frac{n(n-1)a^{n-2}b^2}{2!}$

$+ \frac{n(n-1)(n-2)}{3!} a^{x-3} b^3$

$[x^2 + y]^4 = (x^2)^4 + 4(x^2)^3 y + \frac{4\times 3}{2} (x^2)^2 y^2$

$+ \frac{4\times 3\times 2(x^2)}{3\times 2} + y^4$

Page No.
Date : / /

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

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

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

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

$a = 1 \qquad b = 2$

$\therefore f(a) = -0.367879$

$f(b) = 1.944106$

$\frac{a+b}{2} = \frac{1+2}{2} = 1.5 = x_1$

$f(x_1) = 0.993265$

$x_2 = \frac{1+1.5}{2} = 1.25$

$f(x_2) = 3\log(1.25) - e^{-1.25}$

$f(x_2) = 0.382925$

$x_3 = \frac{1+1.25}{2} = 1.125$

$f(x_3) = 3\log(1.125) - e^{-1.125}$

$\therefore x_4 = \frac{1+1.125}{2}$

$= 1.0625$

$f(x_4) = 3\log(1.0625) - e^{-1.0625}$

$= 0.16372$