Class: XIA/B/C/D
Subject: Mathematics

Time: 3hr.
M.M.: 100

SECTION A (1 X 10)

Q1. Write the equation of the unit circle concentric with the circle $x^2+y^2-8x+4y-8=0$.

Q2. If f(1) =1 , f'(1) =2 then write the value of $\lim_{x \to 1} \frac{\sqrt{f(x)}-1}{\sqrt{x}-1}$

Q3. If the letters of the word MISSISSIPPI are written down at random in a row , what is the probability that 4 s's are together ?

Q4. Write the set of values of x satisfying the inequation $(x^2-2x+1)(x-4)<0$

Q5 If $\cos 4x = 1 + k \sin^2 x \cos^2 x$ then write the value of k.

Q6. Write the distance between the directrices of the hyperbola $x=8\sec\theta$, $y=8\tan\theta$.

Q7. The function f : R→R is defind by $f(x) = \cos^2 x + \sin^4 x$ then write down the range of f (x) .

Q8. Write the eccentricity of an ellipse whose Latus rectum is half of the minor axis .

Q9. If $A \cap B = B$ then which one is true

(i) $A \subset B$ (ii) $B \subset A$ (iii) $A = \phi$ (iv) $B = \phi$

Q10. Find the variance of the data 5 , 9 , 10 , 12 , 8 , 13 , 6 .

SECTION B (4 X 12)

Q11. How many words can be formed by taking 4 letters at a time out of the letters of the word MATHEMATICS .

Q12. Express $1+i$ in the polar form .

Q13. In a class of 35 students , 17 have taken mathematics ,10 have taken mathematics but not economics , Find the no. of students who have taken both mathematics and economics and the no. of students who have taken economics but not mathematics OR

If A ={1,4},B={2,3,6} and C={2,3,7} then find (i) AX(BUC) (ii) AX(B-C)

Q14. Find the general value of θ for $\sqrt{3}\cos\theta + \sin\theta = \sqrt{2}$

Q15. If $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right) = \frac{a}{b}$ then find a and b

Q16. in a Δ ABC $\frac{\sin A}{\sin C} = \frac{\sin(A-B)}{\sin(B-C)}$ then prove that a^2 , b^2 , c^2 are in A.P.

OR

In a Δ ABC if a cosA = b cos B then prove that Δ ABC is either isosceles or right angled .

Q17. Using first principle differentiate $e^{\sqrt{\tan x}}$.

Q18. Find the equation of the parabola with vertex (2,-3) and focus (0,5) . **OR**

Find the vertex , axis , focus , directrix , Latus rectum of the parabola $4y^2+12x-20y+67=0$.

Q19. Find the value of $\lim_{x \to 0} (\cos x)^{\cot x}$. **OR** Evaluate $\lim_{x \to \frac{\pi}{4}} \frac{\tan^3 x - \tan x}{\cos\left(x+\frac{\pi}{4}\right)}$

Q20. A box contains 6 red , 4 white and 5 black balls . A person draws 4 balls from the box at random . Find the probability that among the balls drawn there is at least one ball of each colour .

Q21. If $a_1, a_2, a_3, \ldots\ldots a_n$ are in A.P. where $a_i > 0$ for all i then show that

$$\frac{1}{\sqrt{a_1}+\sqrt{a_2}} + \frac{1}{\sqrt{a_2}+\sqrt{a_3}} + \ldots\ldots\ldots\ldots\ldots + \frac{1}{\sqrt{a_{n-1}}+\sqrt{a_n}} = \frac{n-1}{\sqrt{a_1}+\sqrt{a_n}}$$

Q22. Prove by mathematical induction $(2n+7) < (n+3)^2$.

SECTION C (6 X 7)

Q23. In a Δ ABC prove that $a^3\cos(B-C) + b^3\cos(C-A) + c^3\cos(A-B) = 3abc$.

Q24. The foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$. Find the equation of the hyperbola if its eccentricity is 2 . **OR**

An arc is in the form of a semi ellipse . It is 8m wide and 2m high at the centre . Find the height of the arch at a point 1.5m from one end .

Q25. Using Binomial theorem prove that 6^n-5n always leaves the remainder 1 when divided by 25 .

OR

If the 2nd, 3rd and 4th terms in the expansion of $(x+a)^n$ are 240, 720 and 1080 respectively, find the values of x, a, n.

Q26. Prove that $\frac{\tan 3x}{\tan x}$ never lies between $\frac{1}{3}$ and 3.

Q27. Solve the equation $(x^2-5x+7)-(x-2)(x-3)=1$ **OR**

Prove that the product of r consecutive positive integers is divisible by r!

Q28. Find the mean deviation from the mean of the following distribution

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of students	2	3	8	14	8	3	2

Q29. If f is a function satisfying $f(x+y) = f(x)f(y)$ for all $x, y \in N$ such that $f(1)=3$ and $\sum_{x=1}^{n} f(x) = 120$ then find n

OR

If a, b, c are in G.P. and the equations $ax^2+bx+c=0$ and $dx^2+2ex+f=0$ have a common root , then prove that $\frac{d}{a}, \frac{e}{b}$ and $\frac{f}{c}$ are in A.P.