



DELHI PUBLIC SCHOOL

SAIL TOWNSHIP, RANCHI ANNUAL EXAMINATION (2016-17)

Class:-XI
Time- 3 hrs.

Subject:- Mathematics
M.M-100

General Instructions:-

1. All questions are compulsory.
2. Write question number before writing answer to a question.
3. The question paper is divided into four sections. Section A consists of 4 questions of 1 mark each. Section B consists of 8 questions of 2 marks each. Section C consists of 11 questions of 4 marks each. Section D consist of 6 questions of 6 marks each.
4. For section A, answer the questions in one word or one line or as per exact requirement of the question.
5. There are no overall choices in the question paper. However internal choice has been provided in 4 questions in section C and 2 questions in section D.
6. Use of any electronic device is strictly prohibited.

Section-A

1. Evaluate:-
 $\cos(n+1)A \cdot \cos(n+2)A + \sin(n+1)A \cdot \sin(n+2)A$. [1]
2. Find n if $n+2 = 12n$. [1]
3. If A.M. and G.M of roots of a quadratic equation are 8 and 5 respectively, then obtain the quadratic equation. [1]
4. Find the equation of circle with centre $(-a, -b)$ and radius $\sqrt{a^2 - b^2}$. [1]

Section-B

5. Draw appropriate Venn Diagram for $A' \cap B'$. [2]
6. In a survey of 600 students in a school, 150 students were found to be taking tea and 225 taking coffee, 100 were taking both tea and coffee. How many students were taking neither tea nor coffee. [2]
7. Find the domain and range of the real function f defined by $f(x) = |x - 1|$. [2]
8. If $\tan(\cot x) = \cot(\tan x)$ the prove that $\sin 2x = \frac{4}{(2n+1)\pi}$. [2]
9. Solve for x: $x^2 + x + \frac{1}{\sqrt{2}} = 0$. [2]
10. If $\frac{a+bx}{a-bx} = \frac{b+cx}{b-cx} = \frac{c+dx}{c-dx}$ ($x \neq 0$) then show that a, b, c, d are in G.P. [2]
11. Find the foci and length of latus rectum of the ellipse $\frac{x^2}{100} + \frac{y^2}{400} = 1$. [2]

12. Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contain exactly one letters. Find the probability that at least one letter is in its proper envelope. [2]

Section-C

13. In ΔABC , $a = \frac{1}{\sqrt{6-\sqrt{2}}}$, $b = \frac{1}{\sqrt{6+\sqrt{2}}}$, $C = 60^\circ$ then prove that $c = \frac{\sqrt{3}}{2}$. [4]

14. Prove by using the principle of mathematical induction for all $n \in \mathbb{N}$:-

$$1 \times 2 + 2 \times 3 + 3 \times 4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3} \quad [4]$$

OR

using the principle of mathematical induction, prove that $41^n - 14^n$ is multiple of 27 for all $n \in \mathbb{N}$. [4]

15. If $|z - 2| = 2|z - 1|$, where z is a complex number. Show that $|z|^2 = \frac{4}{3} \operatorname{Re}(z)$. [4]

16. If IQ of a person is given by the formula $IQ = \frac{MA}{CA} \times 100$, where MA is mental age and CA is chronological age. If $80 \leq IQ \leq 140$ for a group of 12 year children, find the range of their mental age.

Write your view about chronological age and mental age. [4]

17. Evaluate using binomial explain.

$$(\sqrt{3} + \sqrt{2})^6 - (\sqrt{3} - \sqrt{2})^6 \quad [4]$$

OR

The coefficients of the $(r-1)$ th, r th and $(r+1)$ th terms in the expansion of $(x+1)^n$ are in the ratio 1:3:5. Find both n and r .

18. Find the coordinates of the foot of perpendicular from the point $(-1, 3)$ to the line $3x - 4y - 12 = 0$. [4]

OR

A person standing at the junction (crossing) of two straight paths represented by the equations $2x-3y+4=0$ and $3x+4y-5=0$, wants to reach the path whose equation is $6x-7y+8=0$ in the least time. Find the equation of the path that should follow.

19. Find the equation of the lines which pass through $(4, 5)$ and make an angle of 45° with the line $2x+y+1=0$. [4]

20. Evaluate :- $\lim_{x \rightarrow 1} \frac{x^4 - \sqrt{x}}{\sqrt{x} - 1}$. [4]

21. Find the derivative of $x \cdot \sin x$ from first principles.

OR

$$\text{If } y = 1 + x + \frac{x^2}{2} + \frac{x^3}{3} + \dots + \frac{x^n}{n},$$

$$\text{Prove that } \frac{dy}{dx} = y - \frac{x^n}{n}. \quad [4]$$

22. Write the following statement in four different ways:
p: If a triangle is equiangular , then it is an obtuse angled triangle. [4]

23. The mean and variance of 7 observations are 8 and 16 respectively. If five of the observations are 2,4,10,12,14. Find the remaining two observations. [4]

Section-D

24. If the letters of the word "RACHIT" are arranged in all possible ways are listed in a dictionary. Determine the rank of the word "RACHIT". Enumerate the importance of dictionary in a student's life. [6]

25. If a, b, c are in A.P. and $\frac{1}{a^2}, \frac{1}{b^2}, \frac{1}{c^2}$, are in A.P., prove that $\frac{-a}{2}, b, c$ are in G.P or else $a = b = c$. [6]

OR

Natural numbers are divided into groups in following way:- 1, (2,3), (4, 5, 6) , (7,8,9,10),.....
Show that the sum of the numbers in the nth. group is $\frac{n(n^2+1)}{2}$.

26. Find the equation of the hyperbola having foci ($\pm 4, 0$) and the latus rectum is of length 12. [6]

OR

An equilateral triangle is inscribed in the parabola $y^2 = 4ax$, where one vertex is at the vertex of the parabola. Find the length of the side of the triangle.

27. Find the equation of the set of points P, the sum of whose distances from A (4,0,0) and B (- 4 , 0, 0) is equal to 10. [6]

28. The mean and standard deviation of a group of 100 observations were found to be 20 and 3 respectively. Later on it was found that three observations were incorrect, which were recorded as 21, 21 and 18. Find the mean and standard deviation if the incorrect observations were omitted.
Write your view that incorrect observations should omitted or corrected. [6]

29. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that
(i) the student opted for NCC or NSS.
(ii) the student has opted neither NCC or NSS.
(iii) the student has opted NSS but not NCC. [6]