श्री Venkateshwar International School

Sector-18, Dwarka, New Delhi-75

ANNUAL EXAMINATION (2024-25)

MATHEMATICS (041)

CLASS – XI

Time: 3 Hours **Max. Marks: 80**

General Instructions

1. **This Question Paper contains 6 pages and 38 questions. There are five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.**
2. **Section A has 18 MCQs and 02 Assertion-Reason based questions of 1 mark each.**
3. **Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.**
4. **Section C has 6 Short Answer (SA)-type questions of 3 marks each.**
5. **Section D has 4 long Answer (LA)-type questions of 5 marks each.**
6. **Section E has 3 source based/ case based/passage based integrated units of assessment (4 marks each) with sub parts.**

SECTION-A

This section has 20 multiple choice questions of 1 mark each.

1. If A = {1, 2, 3, 4, 5} then the number of proper subsets of A is **(1)**

(a) 120 (b) 30 (c) 31 (d) 32

2. Let A be a non-empty set such that A X A has 9 elements among which are found (-1, 0) and (0, 1). Then, **(1)**

(a) A = {-1, 0} (b) A = {0, 1} (c) A = {- 1, 0, 1} (d) A = {-1, 1 }

3. The number of points of intersection of curves y= |sin x| and y = |cos x| in [0, 2π] are. **(1)**

(a) 1 (b) 2 (c) 4 (d) None of these

4. If $\frac{3+2i\,sin\theta}{1-2i\,sin\theta}$ is a real number and $0 < \theta < 2\pi$ then θ is equal to **(1)**

(a) π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$

5. If $\frac{|x-2|}{x-2} \geq 0$, then **(1)**

(a) $x \in [2, \infty)$ (b) $x \in (2, \infty)$ (c) $x \in (-\infty, 2)$ (d) $x \in (\infty, -2)$

6. If ${}^{n}C_{12} = {}^{n}C_{8}$ then n is equal to **(1)**

(a) 20 (b) 12 (c) 6 (d) 30

7. The ratio in which the line $3x + 4y + 2 = 0$ divides the distance between the lines $3x + 4y + 5 = 0$ and $3x + 4y - 5 = 0$ is (1)

(a) 1: 2 (b) 3 : 7 (c) 2: 3 (d) 2 : 5

8. The equation of the line passing through (1, 2) and perpendicular to the line $x + y + 1 = 0$ is (1)

(a) $y - x + 1 = 0$ (b) $y - x - 1 = 0$ (c) $y - x + 2 = 0$ (d) $y - x - 2 = 0$

9. If the focus of a parabola is at (0, -3) and its directrix is $y = 3$ then its equation is (1)

(a) $x^2 = -12y$ (b) $x^2 = 12y$ (c) $y^2 = -12x$ (d) $y^2 = 12x$

10. $\lim_{x \to \pi} \left(\frac{\sin x}{x - \pi}\right)$ is equal to (1)

(a) 1 (b) 2 (c) -1 (d) -2

11. One card is drawn from a pack of 52 cards. The probability that it is the card of a king or spade is (1)

(a) $\frac{1}{26}$ (b) $\frac{3}{26}$ (c) $\frac{4}{13}$ (d) $\frac{3}{13}$

OR

The least value of sinxcosx is

(a) 1 (b) $-\frac{1}{2}$ (c) $\frac{1}{2}$ (d) 0

12. If A and B are mutually exclusive events, P(A) = 0.35 and P(B) = 0.45 then $P(\bar{A} \cap \bar{B})$ is (1)

(a) 0.2 (b) 0.65 (c) 0.55 (d) 0

OR

If $z = x + iy$ satisfies $|z + 1 - i| = |z - 1 + i|$, then

(a) $y = x$ (b) $y = -x$ (c) $x - y + 1 = 0$ (d) $x + y - 1 = 0$

13. The number of terms in the expansion of $(x + a)^{46} - (x - a)^{46}$ after simplification is (1)

(a) 23 (b) 24 (c) 27 (d) 46

14. If second term of a G.P. is 2 and the sum of its infinite terms is 8, then its first term is (1)

(a) 4 (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) 2

15. A plane is parallel to yz-plane, so it is perpendicular to (1)

(a) x-axis (b) y-axis (c) z-axis (d) none of these

16. The equation of the circle concentric with $x^2 + y^2 - 3x + 4y - c = 0$ and passing through (-1, -2) is (1)

(a) $x^2 + y^2 - 3x + 4y - 1 = 0$ (b) $x^2 + y^2 - 3x + 4y + 2 = 0$

(c) $x^2 + y^2 - 3x + 4y = 0$ (d) none of these

17. $\lim_{\theta \to 0} \left(\frac{1 - \cos 4\theta}{1 - \cos 6\theta} \right)$ is equal to (1)

(a) $\frac{4}{9}$ (b) $\frac{1}{2}$ (c) $\frac{-1}{2}$ (d) -1

18. The value of sin 50° - sin70° + sin10° is (1)

(a) 1 (b) 2 (c) 0 (d) 1/3

Assertion- Reason Based Questions

In the following questions, a statement of assertion (A) is followed by a statement of reason(R). Choose the correct answer out of the following choices.

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

19. Statement I: The coordinates of the foot of perpendicular from the point (2, 3) on the line $x + 2y + 7 = 0$ are(-1, -3). (1)

Statement II: Slope of a line perpendicular to the line $ax + by + c = 0$ is b/a

20. Statement I: $\lim_{x \to 0} \left(\frac{\tan x^\circ}{x} \right) = \frac{\pi}{180}$ (1)

Statement II: $\lim_{x \to 0} \left(\frac{\tan x}{x} \right) = 1$

SECTION-B

This section comprises very short answer (VSA) type questions of 2 marks each.

21. (a) Solve : $-5 \leq \frac{2-3x}{4} \leq 9$, $x \in R$ (2)

OR

(b) Solve : $1 \leq |x - 2| \leq 3$, $x \in R$

22. Determine the point in YZ-plane which is equidistant from the points A(2, 0, 3), B(0, 3, 2) and C(0, 0, 1). (2)

23. In an examination, a question paper consists of 12 questions divided into two parts I and II containing 5 and 7 questions respectively. A student is required to attempt 8 questions in all, selecting at least 3 from each part. In how many ways can a student select the questions? (2)

24. Evaluate: $\sum_{k=1}^{11}(2+3^k)$. **(2)**

OR

Show that the ratio of the sum of first n terms of a G.P. to the sum of the terms from (n+1)th (2n)th is $\frac{1}{r^n}$ **(2)**

25. If L = { 1, 2, 3, 4 }, M = { 3, 4, 5, 6 } and N = { 1, 3, 5 }, then verify that

$L - (M \cup N) = (L - M) \cap (L - N)$.

SECTION-C

This section comprises short answer (SA) type questions of 3marks each.

26. (A) Is g = { (1, 1), (2,3), (3, 5), (4, 7) } a function? Justify. If this is described by g(x) = ax +b then what value should be assigned a and b. **(3)**

OR

(B) Redefine and draw the graph of the function f(x) = x + | x + 1 |. Hence find its range.

27. (i) Using binominal theorem find which is larger: $(1.2)^{4000}$ or 800 ? **(1.5)**

(ii) Prove: $\sum_{r=0}^{n} 3^r \cdot {}^nC_r = 4^n$ **(1.5)**

28. (A) Prove: $\cos^4\frac{\pi}{8} + \cos^4\frac{3\pi}{8} + \cos^4\frac{5\pi}{8} + \cos^4\frac{7\pi}{8} = \frac{3}{2}$ **(3)**

OR

(B) Prove: $\sin x.\sin(\frac{\pi}{3} - x).\sin(\frac{\pi}{3} + x) = \frac{1}{4}\sin 3x$

29. If A (1, 4), B(2, -3) and C(-1, -2) are the vertices of Δ ABC, find **(3)**

(i) the equation of median through A.

(ii) the equation of the altitude through A.

30. (A) If three numbers are chosen from the numbers 1, 2, 3,...21, then what is the probability that the numbers chosen are in AP. **(3)**

OR

(B) If 4-digit numbers greater than 5000 are randomly formed from the digits 0, 1, 3, 5 and 7, what is the probability of forming a number divisible by 5 when

(i) the digits may be repeated?

(ii) the repetition of digits not allowed?

OR

(A) Find the equation of the line which is equidistant from the parallel lines 3x + 2y + 6 =0 and 9x + 6y - 7 = 0

OR

(B) Find the equation of the bisector of angle A of triangle ABC, whose vertices are A(4, 3) B (0, 0) and C(2,3)

31. Solve the equation: $|z| = z + 1 + 2i$, where z is a complex number. **(3)**

SECTION-D

This section comprises long answer (LA) type questions of 5 marks each.

32. Calculate mean, variance and standard deviation of the following data: **(5)**

Classes	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
Frequency	3	7	12	15	8	3	2

33. (a) Find the derivatives of the following function: **(3)**

(i) $\frac{x\,tanx}{secx+tanx}$ (ii) $\sin^3 x \cos^3 x$

(b) Find $\lim_{x\to 0} f(x)$ where f(x) = $\begin{cases} 2x+3, & x \le 0 \\ 3(x+1) & x > 0 \end{cases}$ **(2)**

34. (A) (i) Prove that: $\frac{\sin(x+y)-2sinx+\sin(x-y)}{\cos(x+y)-2cosx+\cos(x-y)}$ = tanx **(2.5)**

(ii) Prove that: cosx cos2x cos4x cos8x = $\frac{sin16x}{16sinx}$ **(2.5)**

OR

(B) Prove that cot A – tan A = 2 cot 2A and deduce that

tan x + 2 tan 2x + 4 tan 4x + 8 cot 8x = cot x

35. (A) (i) Find the equation of the circle passing through the points (2, 3), (-1, 1) and whose centre lies on the line x – 3y -11 = 0. **(3)**

(ii) Find the equation of ellipse if its foci are $(\pm 2, 0)$ and the length of latus-rectum is $\frac{10}{3}$. **(2)**

OR

(B) (i) Find the equation of the circle passing through the points (1, 2), (3, -4), (5, -6). **(3)**

(ii) Find the equation of the hyperbola whose vertices are $(\pm 7, 0)$ and eccentricity is $\frac{4}{3}$. **(2)**

SECTION-E

This section comprises 3 case-study based questions of 4 marks each.

36. The number of bacteria in a certain culture doubles every hour. Given that the number of bacteria present at the end of 4th hour was 160000.

Based on the above information, answer the following questions

(i) Find the number of bacteria present originally. **(1)**

(ii) Find the number of bacteria present at the end of 7th hour. **(1)**

(iii) Find the sum of number of bacteria present originally to the end of 8th hour. **(2)**

OR

(iii) If the number of bacteria triples every hour, then find the number of bacteria present at the end of 4th hour.

37. Five couples were invited to a tea party. They were asked to sit on one side of a long table. Based on the above information, answer the following questions

(i) Find the number of ways in which five couples can be seated. **(1)**

(ii) Find the member of ways in which all males sit together and all females sit together. **(1)**

(iii) Find the number of ways in which no two females sit together. **(2)**

OR

(iii) Find the number of ways in which all females are never together

38. Ravi and Siddhartha are playing cards. Total number of cards are 52 in numbers. Each of them draw cards one by one. On the basis of this game following questions are observed, answer the following questions.

(i) If Ravi draws four cards, find the probability that all the four cards are from the same suit. **(2)**

(ii) If Siddhartha draws four cards, find the probability that one card is drawn from each suit. **(2)**

OR

Given $\sin x - \sin y = p$ and $\cos x - \cos y = q$

Based on the above information, answer the following questions:

(i) Find the value of $\cos(x - y)$ **(2)**

OR

(i) Find the value of $\tan(\frac{x+y}{2})$ **(2)**

(ii) Find the value of $\sin(x + y)$ **(1)**

(iii) Find the value of $\cos(x + y)$ **(1)**