



Jh Venkateshwar International School

Sector-18, Dwarka, New Delhi-75
ANNUAL EXAMINATION (2023 – 24)
MATHEMATICS – XI (041)
(ADDITIONAL)

Time: 3 Hours

Max. Marks: 80

General Instructions:

1. This Question Paper contains 5 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 Very Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Very Short 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

Section A consists of 20 questions of 1 mark each

- Q.1.** Number of subsets of a set containing 4 elements is (1)
(a) 4^2 (b) $4^2 - 1$ (c) 2^4 (d) $2^4 - 1$
- Q.2.** The probability that a non-leap year selected at random will have 53 Tuesday or Wednesdays is (1)
(a) $\frac{3}{7}$ (b) $\frac{2}{7}$ (c) $\frac{1}{7}$ (d) $\frac{4}{7}$
- Q.3.** If $f(x) - 3f\left(\frac{1}{x}\right) = 2x + 3$ ($x \neq 0$), then $f(3)$ is equal to (1)
(a) $-\frac{3}{2}$ (b) $-\frac{5}{2}$ (c) $\frac{7}{2}$ (d) -1
- Q.4.** If $A = \{a, b\}$ and $B = \{x, y, z\}$, then the number of relations from B to A is (1)
(a) 8 (b) 16 (c) 32 (d) 64
- Q.5.** The distance of the point P (-3, 4, 5) from yz plane is (1)
(a) 3 units (b) 4 units (c) 5 units (d) None of these
- Q6.** The greatest value of $\sin x \cdot \cos x$ is (1)
(a) 1 (b) 2 (c) $\sqrt{2}$ (d) $\frac{1}{2}$
- Q7.** If $Z = \bar{Z}$, then Z lies on (1)
(a) x-axis (b) y-axis (c) origin (d) none of these

- Q8.** If Z is a complex number, then **(1)**
- (a) $|z^2| > |z|^2$ (b) $|z|^2 > |z^2|$ (c) $|z|^2 = |z^2|$ (d) $|z|^2 \geq |z^2|$
- Q9.** If $|x - 2| \geq 7, x \in \mathbb{R}$ **(1)**
- (a) $x \in [-5, 9]$ (b) $x \in (-5, 9]$
(c) $x \in (-\infty, -5] \cup [9, \infty)$ (d) $x \in (-\infty, -5) \cup (9, \infty)$
- Q10.** While shuffling a pack of 52 cards, 2 cards are accidentally dropped. The probability that missing cards are of different colours is **(1)**
- (a) $\frac{26}{51}$ (b) $\frac{25}{51}$ (c) $\frac{1}{2}$ (d) $\frac{25}{52}$
- Q11.** The number of 3 digit odd numbers, when repetition of digits is allowed is **(1)**
- (a) 450 (b) 360 (c) 400 (d) 420
- Q12.** If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x = 1$ is **(1)**
- (a) 1 (b) 0 (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$
- Q13.** The number of terms in the expansion of $(x + a)^{53} - (x - a)^{53}$ after simplification is **(1)**
- (a) 106 (b) 26 (c) 27 (d) 53
- Q14.** If the ratio of A.M to G.M of two positive numbers a and b is $5 : 3$, then $a : b$ **(1)**
- (a) $3 : 5$ (b) $2 : 9$ (c) $9 : 1$ (d) $5 : 3$
- Q15.** If the lines $4x + 3y = 60$ and $3x + ky = 9$ are perpendicular to each other, then the value of k is **(1)**
- (a) - 4 (b) - 3 (c) 2 (d) $-\frac{1}{2}$
- Q16.** The medians AD and BE of a triangle with vertices $A(0, b)$, $B(0, 0)$, $C(a, 0)$ are perpendicular to each other, if **(1)**
- (a) $a = \frac{b}{2}$ (b) $b = \frac{a}{2}$ (c) $ab = 1$ (d) $a = \pm\sqrt{2}b$
- Q17.** $\lim_{x \rightarrow 0} \frac{\sqrt{2} - \sqrt{1 + \cos x}}{\sin^2 x}$ is equal to **(1)**
- (a) $\frac{1}{4\sqrt{2}}$ (b) $\frac{4}{3}$ (c) $\frac{1}{\sqrt{2}}$ (d) none of these

Q18. The equation of circle whose centre is (4, 5) and which passes through the centre of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ (1)

(a) $x^2 + y^2 + 6x - 4y - 23 = 0$

(b) $x^2 + y^2 - 8x - 10y - 9 = 0$

(c) $x^2 + y^2 - 6x + 4y - 12 = 0$

(d) $x^2 + y^2 + 6x + 4y + 9 = 0$

Each question consists of two statements, namely, Assertion (A) and Reason (R). For selecting the correct answer, use the following code:

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

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

(c) (A) is true and (R) is false.

(d) (A) is false and (R) is true.

Q19. Assertion (A) : If $A \subset B$ then $A \cap B = A$ (1)

Reason (R) : If A and B are two sets, then $A \subset B$ means every element of A is also an element of B.

Q20. Assertion (A) : Total number of terms in the expansion of $(x^2 - 4x + 4)^3$ are 6. (1)

Reason (R) : Total number of terms in the binomial expansion with exponent n are (n + 1).

SECTION – B

Section B consists of 5 questions of 2 marks each.

Q21. Solve for real x: $\frac{2x-3}{4} + 9 \geq 3 + \frac{4x}{3}$ (2)

Q22. Find the domain and range of the function $f(x) = \sqrt{9 - x^2}$ (2)

Q23. If $\frac{(a+i)^2}{(2a-i)} = p + iq$, show that $p^2 + q^2 = \frac{(a^2+1)^2}{(4a^2+1)}$ (2)

OR

Find all non-zero complex numbers z satisfying $\bar{z} = iz^2$

Q24. A bag contains 50 tickets numbered 1, 2, 3, ..., 50 of which five are drawn at random and arranged in ascending order of magnitude. Find the probability that third number is 30. (2)

Q25. Show that the the points (1, 2, 3), (-1, -2, -1), (2, 3, 2) and (4, 7, 6) are the vertices of a parallelogram. (2)

OR

Find the locus of the point which is equidistant from the points (0, 2, 3) and

(2, -2, 1)

SECTION – C

Section C consists of 5 questions of 2 marks each.

- Q26.** Find the equation of the circle passing through the points (1, -2) and (4, -3) and whose centre lies on the line $3x + 4y = 7$ (3)
- Q27.** If $\sin x = \frac{\sqrt{5}}{3}$ and x lies in third quadrant, find the values of $\cos \frac{x}{2}$, $\sin \frac{x}{2}$, and $\tan \frac{x}{2}$. (3)
- Q28.** Evaluate: $\lim_{x \rightarrow 0} \frac{1 - \cos x \sqrt{\cos 2x}}{x^2}$ (3)

OR

$$\text{Let } f(x) = \begin{cases} a + bx, & x < 1 \\ 4, & x = 1 \\ b - ax, & x > 1 \end{cases}$$

Find the value of a and b if $\lim_{x \rightarrow 1} f(x) = f(1)$

- Q29.** If a and b are distinct integers, prove that $a^n - b^n$ is divisible by $(a - b)$, whenever n is a natural number. (3)

OR

Expand using Binomial expansion $(1 + x + x^2)^3$ (3)

- Q30.** Find the derivatives of the (a) $\frac{x^2 \sin x}{\cos x}$ (b) $\sin 3x \cdot \cos^3 x$ (3)
- Q31.** Find the equation of the line which passes through the point (3,4) and the sum of its intercepts on the axes is 14. (3)

OR

Two lines passing through the point (2, 3) intersect each other at an angle of 60° . If slope of one line is 2, find the equation of other line.

SECTION – D

Section D consists of 4 questions of 5 marks each

- Q32.** Prove that: $\sin 3A \sin^3 A + \cos 3A \cos^3 A = \cos^3 2A$ (5)

OR

Prove that: $\cos^2 A + \cos^2 \left(A + \frac{2\pi}{3} \right) + \cos^2 \left(A - \frac{2\pi}{3} \right) = \frac{3}{2}$

- Q33.** (a) Find three numbers in G.P whose sum is 52 and the sum of whose products in pairs is 624. (3)
- (b) Find the sum of 50 terms of the sequence 8, 88, 888, 8888... (2)
- Q34.** (a) Find the image of the point (- 8, 12) with respect to the line mirror

$$4x + 7y + 13 = 0 \quad (2.5)$$

(b) Find the derivative using first principle: $f(x) = \sqrt{ax + b}$ (2.5)

Q35. Calculate mean, Variance and Standard Deviation of the following frequency distribution: (5)

Classes	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60
Frequencies	11	29	18	4	5	3

SECTION – E

Section E consists of Case Based / Source based questions of 4 marks each

Q36. In a game a girl rolls a die, if she gets an even number she will toss a coin if she gets a head on the coin, she will win ` 10. If she gets tail in the coin she will win ` 5. If she gets odd number in die she has to pay ` 20 to organiser. On the basis of above case study answer the following:

- (i) Find the total number of sample points in sample space. (1)
- (ii) Find the probability girl will win ` 10. (1)
- (iii) Find the probability that girl will win ` 5. (2)

OR

Find the probability that girl will pay ` 20 to organiser.

Q37. There are 10 mathematics teachers and 20 students in the school mathematics magazine editorial team. This year the team decided to form a committee of 2 teachers and 3 students who will look after a special section in magazine- Insight in Mathematics Modeling (IMM).

Help the team to find out :

- (i) In how many ways committee can be formed from the Editorial Team? (1)
- (ii) In how many ways a particular student from the Editorial Team can be included in the committee ? (1)
- (iii) In how many ways a particular teacher can be included in the committee? (2)

OR

In how many ways a particular student can be excluded from IMM?

Q38. The belt of a swing is parabolic in shape represented by the function $f : \mathbb{R} \rightarrow \mathbb{R}$ by

$$y = f(x) = x^2$$

Based on above information, answer the following questions:

- (i) Find the domain and range of $f(x)$ (2)
- (ii) Draw the graph of $f(x) = x^2$ $0 \leq x < 2$ (2)

OR

Draw the graph of $f(x) = x^2$, $-1 < x < 1$