ANNUAL EXAMINATION

M XI-M2

Class 11 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question paper contains - 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 MCQ's 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

1. The set A = {x : x $\in$ R, x^2 = 16 and 2x = 6} equals **[1]**

   a) ϕ b) {3}

   c) {4} d) {14, 3, 4}

2. If n(U) = 700, n(A) = 200, n(B) = 300 and n(A $\cap$ B) = 100, then n (A' $\cap$ B') is **[1]**

   a) 600 b) 300

   c) 200 d) 400

3. A relation R is defined from {2, 3, 4, 5} to {3, 6, 7, 10} by x Ry $\Leftrightarrow$ x is relatively prime to y. Then, domain of R is **[1]**

   a) {3, 5} b) {2, 3, 4, 5}

   c) {2, 3, 5} d) {2, 3, 4}

4. For any angle θ, the expression $\frac{2\cos 8\theta+1}{2\cos\theta+1}$ = **[1]**

   a) (2 cos θ + 1)(2 cos 2θ + 1)(2 cos 4θ + 1) b) (2 cos θ - 1)(2 cos 2θ - 1)(2 cos 4θ - 1)

   c) (cos θ - 1)(cos 2θ - 1)(cos 4θ - 1) d) (2 cos θ + 1)(2 cos 2θ + 1)(2 cos 4θ - 1)

5. In a triangle ABC, sin A : sin B : sin C = 4 : 5 : 6, while cos A : cos B : cos C = x : y : 2. The ordered pair (x, y) is: **[1]**

   a) (12, 9) b) (5, 4)

   c) (9, 6) d) (10, 5)

6. For all complex numbers z_1, z_2 satisfying $|z_1|$ = 12 and Iz_2 - 3 - 4i| = 5, the minimum value of $|z_1 - z_2|$ is **[1]**

a) 2 b) 7

c) 17 d) 0

7. If $z = \frac{1}{(2+3i)^2}$, then |z| = **[1]**

a) $\frac{1}{13}$ b) $\frac{1}{5}$

c) None of these d) $\frac{1}{12}$

8. The solution set for $|3x - 2| \leq \frac{1}{2}$ **[1]**

a) none of these b) $[\frac{2}{3}, \frac{2}{3}]$

c) $[\frac{1}{2}, \frac{5}{6}]$ d) $[\frac{5}{6}, \frac{1}{2}]$

9. A number is called a PALINDROME if it is same read forward or backward. Thus 12521 and 979 are palindromes. The total number of 5 digit palindromes are **[1]**

a) 990 b) 90000

c) 1000 d) 900

10. The number of terms in the expansion of $\{(x + a)^{16} + (x - a)^{16}\}$ is **[1]**

a) 9 b) 7

c) 8 d) 17

11. Let $A_n = \left(\frac{3}{4}\right) - \left(\frac{3}{4}\right)^2 + \left(\frac{3}{4}\right)^3 - ... + (-1)^{n-1} \left(\frac{3}{4}\right)^n$ and $B_n = 1 - A_n$. Then, the least odd natural number p, so that $B_n > A_n$, for all $n \geq p$ is **[1]**

a) 11 b) 7

c) 5 d) 9

12. If five G.M.s are inserted between 486 and $\frac{2}{3}$, then fourth G.M. equals **[1]**

a) 6 b) 12

c) 4 d) -6

13. If a point R(4, y, z) lies on the line segment joining the points P{2, -3, 4) and Q(8, 0, 10), then the distance of R from the origin is **[1]**

a) 6 b) $\sqrt{53}$

c) $2\sqrt{21}$ d) $2\sqrt{14}$

14. P is any point on the ellipse $9x^2 + 36y^2 = 324$, whose foci are S and S'. Then SP + S'P equals **[1]**

a) 324 b) 36

c) 12 d) 3

15. The distance of a point P(a, b, c) from x-axis is **[1]**

a) $b^2 + c^2$ b) $\sqrt{a^2 + b^2}$

c) $\sqrt{b^2 + c^2}$ d) $\sqrt{a^2 + c^2}$

16. The equation $\vec{r} = \lambda\hat{k}$ represents **[1]**

a) the X axis b) the Y axis

c) none of these

d) the Z axis

17. $\lim_{x\to\infty} \frac{\sin x}{x}$ = **[1]**

a) None of these

b) 1

c) ∞

d) 0

18. **Assertion (A):** The difference between maximum and minimum values of variate is called Range. **[1]**

Reason (R): Coeff. of Range = $\frac{L-S}{L+S}$

Where, L is the largest value

S is the smallest value

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. **Assertion (A):** The mean deviation about the mean for the data 4, 7, 8, 9, 10, 12, 13, 17 is 3. **[1]**

Reason (R): The mean deviation about the mean for the data 38, 70, 48, 40, 42, 55, 63, 46, 54, 44 is 8.5.

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.

20. A box contains 100 tickets numbered 1, 2, 3,.....,100. Two tickets are chosen at random. If it is given that Maximum number on the two chosen tickets is not more than 10, then the probability that the minimum number on them is not less than 5 is, **[1]**

a) $\frac{2}{3}$

b) $\frac{1}{3}$

c) none of these

d) $\frac{2}{5}$

Section B

21. If A = {a, b, c, d, e}, B = {a, c, e, g} and C = {b, e, f, g}, verify that: A ∩ C = C ∩ A **[2]**

OR

Write the subsets of R as intervals: {x : x ∈ R, $0 \leq x \leq 7$} Also, find the length of interval.

22. A = {1, 2, 3, 5} and B = {4, 6, 9}. Define a relation R from A to B by R = {(x, y): the difference between x and y is odd: $x \in A,\ y \in B\}$. Write R in roster form. **[2]**

23. Prove that: tan 225° cot 405° + tan 765° cot 675° = 0. **[2]**

24. Using distance formula prove that the points are collinear: P (0, 7, -7), Q (1, 4, -5) and R (-1, 10, -9). **[2]**

25. Find the probability that in a random arrangement of the letters of the word 'UNIVERSITY', the two I's do not come together. **[2]**

Section C

26. Prove that: sin x + sin y + sin z - sin (x + y + z) = 4 sin $\frac{x+y}{2} \times$ sin $\frac{y+z}{2} \times$ sin $\frac{z+x}{2}$ **[3]**

OR

Find the value of other five trigonometric function: sin $x = \frac{3}{5}$, x lies in second quadrant.

27. Find the multiplicative inverse of the complex numbers $= \sqrt{5} + 3i$ **[3]**

28. Using binomial theorem, expand: $(\sqrt{x} + \sqrt{y})^8$ **[3]**

29. The (m + n)th and the (m - n)th terms of a GP are p and q respectively. Show that the mth and the nth terms of the GP are $\sqrt{pq}$ and $p \cdot \left(\frac{q}{p}\right)^{(m/2n)}$ respectively. **[3]**

OR

If a, b, c, d are in GP, prove that $(a + b + c + d)^2 = (a + b)^2 + 2(b + c)^2 + (c + d)^2$.

30. A(-4, 2), B(2, 6), C (8,5) and D (9,-7) are the vertices of a quadrilateral ABCD. If P , Q, R, S are the midpoints of AB, BC, CD and DA respectively, using slopes, show that PQRS is a parallelogram. **[3]**

31. Find the coordinates of the focus and the vertex, the equations of the directrix and the axis, and length of the latus rectum of the parabola: $3y^2 = 8x$ **[3]**

Section D

32. If A = {a,d}, B = {b, c, e} and C = {b, c, f}, then verify that **[5]**

i. $A \times (B \cup C) = (A \times B) \cup (A \times C)$

ii. $A \times (B \cap C) = (A \times B) \cap (A \times C)$

OR

i. Let R be the relation on the set Z of all integers defined by R = {(x, y): x - y is divisible by n}. Prove that

a. $(x, y) \in R$

$\Rightarrow (y, x) \in R$ for all $x, y \in Z$.

b. $(x, y) \in R$ and $(y, z) \in R$

$\Rightarrow (x, z) \in R$ for all $x, y, z \in Z$.

ii. Find the domain and range of the function $f(x) = \frac{x^2-9}{x-3}$.

iii. Find the domain of the function $f(x) = \frac{x^2+3x+5}{x^2+x-6}$.

33. Solve the following system of linear inequalities **[5]**

$-2 - \frac{x}{4} \geq \frac{1+x}{3}$ and $3 - x < 4(x-3)$

34. Evaluate the following limits: $\lim_{x \to \sqrt{10}} \frac{\sqrt{7+2x}-(\sqrt{5}+\sqrt{2})}{x^2-10}$. **[5]**

35. Calculate the mean, median and standard deviation of the following distribution: **[5]**

Class-interval:	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70
Frequency:	2	3	8	12	16	5	2	3

OR

Find the mean deviation about the median for the data:

Class	0 -10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	6	8	11	18	5	2

Section E

36. In a prize distribution ceremony, there are 3 prizes to be distributed among 4 students. Vinod is there in this ceremony and he is trying to calculate the ways these prizes can be distributed among 4 students using different permutations and combinations. **[4]**

In how many ways, can 3 prizes be distributed among 4 boys, when

i. no boy gets more than one prize?

ii. a boy may get any number of prizes?

37. Suppose that each child born is equally likely to be a boy or a girl. Consider a family with exactly three children. **[4]**

1. List the eight elements in the sample space whose outcomes are all possible genders of the three children.
2. Write each of the following events as a set and find its probability :
    1. The event that exactly one child is a girl.
    2. The event that at least two children are girls
    3. The event that no child is a girl

38. A class has 175 students. The following description gives the number of students studying one or more of the subjects in this class: mathematics 100, physics 70, chemistry 46; mathematics and physics 30; mathematics and chemistry 28; physics and chemistry 23; mathematics, physics and chemistry 18. Find **[4]**

i. how many students are enrolled in mathematics alone, physics alone and chemistry alone,

ii. the number of students who have not offered any of these subjects.