**Paper – Mathematics**
**Class - XI**

Time : 3 hrs. M. M. 100

## SECTION :- A

**QUESTION NUMBER 1 TO 6 CARRY 1 MARK EACH.**

1. Write the sum of the series : $1 + \frac{2}{3} + \frac{4}{9} + \cdots$ to 6 terms.
2. Find the equation of the straight line which makes an angle of 120° with $x$-axis and cuts of an intercept $-3$ from the $y$-axis.
3. Two dice are thrown simultaneously. What is the probability of getting a total of 4?
4. If $\tan 2x = \cot(n-2)x$, then what is $x$ =?
5. A circular hall has six doors. In how many ways can a dancer enter the hall through one door and leave it through a different door?
6. Find the equation of the straight line joining the points $(a, b)$ and $\{(a+b), (a-b)\}$.

## SECTION – B

**QUESTION NUMBER 7 TO 19 CARRY 4 MARKS EACH.**

7. Prove by using the principle of mathematical induction for all $n \in N$ :
$$a + ar + ar^2 + \cdots + a^{n-1} = \frac{a(r^n - 1)}{r - 1}$$
8. Find the square root of $3 + 4i$.
9. Write the negation of the following statements and check whether the resulting statements are true :
(i) The sum of 3 and 4 is 9. (ii) Every natural number is greater than 0.
(iii) Australia is continent.
10. The probability that a student passes a Physics test is $\frac{2}{3}$ and the probability that he passes both a Physics test and an English test is $\frac{14}{45}$. The probability that he passes at least one test is $\frac{4}{5}$. What is the probability that he passes the English test?

OR

A sub-committee of 6 members is to be formed out of a group consisting of 7 men and 4 women. Calculate the probability that the sub-committee will consist of at least 2 women.

11. Find the ratio in which the $yz$-plane divides the line segment formed by joining the points $(-2, 4, 7)$ and $(3, -5, 8)$.
12. If $a + b + c \neq 0$ and $\frac{b+c}{a}, \frac{c+a}{b}, \frac{a+b}{c}$ are in A.P., then prove that $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are also in A.P.

OR

Insert three numbers between 1 and 256 so that the resulting sequence is a G.P.

13. Prove that : $\frac{\tan(A+B)}{\cot(A-B)} = \frac{tan^2A - tan^2B}{1 - tan^2A\, tan^2B}$

OR

Find the general solution of the equation : $\cos 4x = \cos 2x$.

14. Roads along $3x - 2y + 7 = 0$ and $2x + 3y = 30$ intersect at $C$. Locate $C$. Show that the two roads are at right angle at $C$. A river is flowing along $y$-axis. A beautiful triangular park is to be developed between the roads and the river. What is the area of the park if all distances are measured in km?
What is the importance of green fields and parks in city life?
15. If the equation of a parabola is $x^2 = -16y$, find the coordinates of the focus, the equation of the directrix and the length of the latus rectum.
16. In a group of 40 student 26 takes coffee and 8 take neither of the two. How many take both tea and coffee?
17. From a committee of 8 persons, in how many ways can we choose a chairman and vice-chairman assuming one person cannot hold more than one position?

OR

How many words, with or without meaning can be made from the letters of the word MONDAY, assuming no letter is repeated, if
(i) 4 letters are used at a time? (ii) all letters are used at a time?
(iii) all letters are used but first letter is a vowel?

18. If $\cos(A+B)\sin(C-D) = \cos(A-B)\sin(C+D)$, then show that $\tan A \tan B \tan C + \tan D = 0$.

**19.** Find the equation of the ellipse in the form $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, having vertices at $(0,\pm 10)$ and eccentricity $e=\frac{4}{5}$.

## SECTION C

**QUESTION NUMBER 20 TO 26 CARRY 6 MARKS EACH.**

**20.** Prove that : $cos^3 x + cos^3\,(120° + x) + cos^3(240° + x) = \frac{3}{4}\cos 3x$

OR

(i) If $A + B = 45°$, prove that : $(1 + \tan A)(1 + \tan B) = 2$

(ii) Solve the equation : $\sin 2x + \sin 4x + \sin 6x = 0$.

**21.** (i) A solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6%boric acid. If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added.

(ii) solve the following system of inequalities graphically : $x + y \leq 6, x + y \geq 4$

**22.** Find the sum of $n$ terms of the series : $5 + 11 + 29 + 41 + \cdots$

**23.** (i) Evaluate : $\lim\limits_{x\to 2}\frac{x^3-6x^2+11x-6}{x^2-6x+8}$.

(ii) Find the derivative of the function : $\frac{\sec x+\tan x}{\sec x-\tan x}$

**24.** The mean and standard deviation of marks obtained by 50 students of a class in three subjects, mathematics, physics and chemistry are given below :

| Subject | Mathematics | Physics | Chemistry |
|---|---|---|---|
| Mean | 42 | 32 | 40.9 |
| Standard Deviation | 12 | 15 | 20 |

Which of the three subjects the highest variability in marks and which shows the lowest?

**25.** The mean and standard deviation of 100 observations were calculated as 40 and 5.1, respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct means and standard deviation.

**26.** The second, third and fourth terms in the binomial expansion $(x + a)^n$ are 240, 720 and 1080, respectively. Find $x, a$ and $n$.