Session Ending Examination (2015-2016) Set - 3
Class XI (Mathematics)

Time: 3 Hrs M.M=100

General Instructions:

a) All the questions are compulsory.

b) The Question Paper consists of 26 Questions divided into three sections A,B and C

c) Section-A comprises of 6 questions of one mark each.

d) Section-B consists of 13 questions of four marks each.

e) Section-C comprises of 7 questions of Six marks each.

f) There is no overall choice. However, an internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.

g) Use of calculator, is not permitted.

Section A

1. If f(x) = $\dfrac{2x}{1+x^2}$, then find the value of $f\left(\tan\dfrac{\pi}{6}\right)$.

2. Find the multiplicative inverse of 3 + 2i.

3. Write the truth value of the following statement. "The square of a number is an even number".

4. Find the length of latusrectum of the ellipse $x^2 + 4y^2 = 9$.

5. Write the negation of the following statement. 'For every real number x, x is less than x + 1'.

6. Write the converse of the following statement. 'I go to a beach whenever it is a sunny day'.

Section B

7. If U = $\{x \in N \mid x \le 9\}$; A = {x : x is an even number, 0 < x < 10}; B = {2, 3, 5, 7}, then verify that $(A \cup B)' = A' \cap B'$

8. Prove that cot 4x (sin 5x + sin 3x) = cot x (sin 5x - sin 3x).

9. Prove that $\left(\cos x + \cos y \right)^2 + \left(\sin x - \sin y \right)^2 = 4 \cos^2 \left(\dfrac{x+y}{2} \right)$.

Or

Prove that cot x cot 2x - cot 2x cot 3x – cot 3x cot x = 1

10. Represent the complex number $\dfrac{-4}{1+\sqrt{3}i}$ in polar form.

11. Solve the system of in-equations $\dfrac{x+3}{x-2} \le -2$, $\dfrac{2x+5}{x+7} \le 3$

Or

Solve $\left| \dfrac{4x-5}{3} \right| \le \dfrac{5}{3}$.

12. What is the number of ways of choosing 4 cards from a pack of 52 cards? In how many of these

(i) four cards are of the same suite? **(ii)** two are red cards and two are black cards?

13. Prove that cos 6x = $32 \cos^6 x - 48 \cos^4 x$

14. Twenty students wearing shirt with slogan 'SAVE ENVIRONMENT" are standing on a bench represented by the equation 3x + y + 1 = 0. A spot light is placed at the point (1, 2). Find the foot of the perpendicular from (1, 2) to the line 3x + y + l = 0. What do you think these students want to give the message?

15. Find the equation of set of points P which moves so that its distances from the points (3,4, - 5) and (-2, 1, 4) are equal.

Or

Find the ratio in which the plane x - 2y + 3z = 17 divides the line joining the points (-2, 4, 7) and (3, - 5, 8). Also, find the coordinates of point of intersection.

16. A visitor with sign board 'DO NOT LITTER' is moving on a circular path in an exhibition. During the movement, he stops at points represented by (3, 7), (5, 5) and centre of the circular path is on the line x - 4y = 1 Write the equation of circular path.

17. Find the variance of first n natural numbers.

18. In an entrance test that is graded on the basis of two examinations, the probability of a randomly chosen student passing the first examination is 0.8 and the probability of passing the second examination is 0.7. The probability of passing at least one of them is 0.95. What is the probability of passing both?

+-9

Or

If A and B are two mutually exclusive events of a random experiment and $P(A \cup B)$ = 0.75 and $P(\overline{A})$ = 0.6, then find (B).

19. Find the mean deviation from mean for the following data

Class interval	95-105	150-115	115-125	125-135	135-145	145-155
Frequency	9	13	26	30	12	10

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Section C

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20. In a survey of 25 students, it was found that 15 had taken Mathematics, 12 had taken Physics and 11 had taken Chemistry; 5 had taken Mathematics and Chemistry, 9 had taken Mathematics and Physics, 4 had taken Physics and Chemistry and 3 had taken all the three subjects.

(i) Find the number of students that had taken none of the subjects. **(ii)** In your opinion,

which subject is more interesting and why?

21. If $\sin \theta = \dfrac{3}{5}$ and $\cos \phi = -\dfrac{12}{13}$, where θ and ϕ both lie in the second quadrant, then find the value of $\tan (\theta - \phi)$.

Or

If a $a \cos 2\theta + b \sin 2\theta = c$ has α and β as its, then prove that $\tan \alpha + \tan \beta = \dfrac{2b}{a+c}$

22. Prove that by using Principle of Mathematical Induction,

$1.3 + 2.3^2 + 3.3^3 + \ldots + n.3^n = \dfrac{(2n-1)3^{n+1} + 3}{4}, \ \forall n \in N$.

23. Solve the following system of in-equations graphically $3x + 2y \le 150$, $x + 4y \ge 80$, $x \le 15$, $x \ge 0$, $y \ge 0$

24. Using binomial theorem, prove that $6^n - 5n$ always leaves remainder 1 when divided by

25. Find the sum of first n terms of the series 3 + 7 + 13 + 21 + 31..........

Or

If $a_1, a_2, a_3, \ldots, a_n$ are in AP, where $a_1 > 0$ for all i, then show that

$$\dfrac{1}{\sqrt{a_1} + \sqrt{a_2}} + \dfrac{1}{\sqrt{a_2} + \sqrt{a_3}} \ldots + \dfrac{1}{\sqrt{a_{n-1}} + \sqrt{a_n}} = \dfrac{n-1}{\sqrt{a_1} + \sqrt{a_n}}$$

26. (i) Differentiate $\dfrac{x}{1 + \tan x}$ with respect to x.

(ii) Evaluate $\lim\limits_{x \to 0} \dfrac{(1+x)^6 - 1}{(1+x)^2 - 1}$