Sample Paper – 2010
Class – XI
Subject - Mathematics

General Instructions:

1. All questions are compulsory.
2. The question paper consist of 29 questions divided into three sections A, B and C. Section A comprises of 10 questions of one mark each, section B comprises of 12 questions of four marks each and section C comprises of 7 questions of six marks each.
3. All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.
4. There is no overall choice. However, 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.
5. Use of calculators is not permitted. You may ask for logarithmic tables, if required.

SECTION – A

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1. If $U=\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A=\{2, 4, 6, 8\}$ and $B=\{2, 3, 5, 7\}$. Verify that $(A \cup B)' = A' \cap B'$.
2. A function f is defined by $f(x)=2x-5$. Find $f(-3)$.
3. Evaluate: $\dfrac{\cos 7x+\cos 5x}{\sin 7x-\sin 5x}$.
4. Express the complex number $z=\dfrac{2+i}{(1+i)(1-i)}$ in x+ i y form.
5. If $\left(\dfrac{1+i}{1-i}\right)^m=1$, then find the least integral value of m.
6. Find n if ${}^{n-1}P_3 : {}^{n}P_4 = 1:9$.
7. Find the equation of a line perpendicular to the line $x-2y+3=0$ and passing through the point $(1, -2)$.
8. Find the centre and radius of the circle $3x^2+3y^2+4x-6y-4=0$.
9. Evaluate: $\lim\limits_{x\to 0}\dfrac{\sqrt{x+1}-1}{x}$.
10. If E and F are events such that $P(E)=\dfrac{1}{4}$, $P(F)=\dfrac{1}{2}$ and $P(E \text{ and } F)=\dfrac{1}{8}$, find $P(E \text{ or } F)$.

SECTION – B

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11. Let $A=\{1, 2\}$, $B=\{1, 2, 3, 4\}$, $C=\{5, 6\}$ & $D=\{5, 6, 7, 8\}$. Verify that $A\times(B\cap C)=(A\times B)\cap(A\times C)$.

OR

In a survey of 600 students in a school, 150 students were found to be taking tea and 225 taking coffee,100 were taking both tea and coffee. Find how many students were taking neither tea nor coffee?

12. If $\sin x = \frac{3}{5}, \cos y = -\frac{12}{13}$, where x and y both lie in II quadrant, find the value of $\sin(x+y)$.

13. Prove the following by the principle of mathematical induction :

$$\frac{1}{1\times 3}+\frac{1}{3\times 5}+\frac{1}{5\times 7}+....+\frac{1}{(2n-1)(2n+1)}=\frac{n}{(2n+1)}, \quad \forall n \in N.$$

OR

Using the principle of mathematical induction, prove that:

$$\left(1+\frac{1}{1}\right)\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)......\left(1+\frac{1}{n}\right)=(n+1), \forall n \in N.$$

14. Find the modulus and argument of the complex number $z=\frac{(1+i)^{13}}{(1-i)^{7}}$.

15. Solve the following system of inequations graphically

$2x+y\le 24$; $x+y\le 11$; $2x+5y\le 40$; $x\ge 0$; $y\ge 0$.

OR

Solve $-3\le \frac{4-7x}{2}\le 18$.

16. Find the number of different signals that can be generated by arranging atleast two flags in order (one below the other) on a vertical staff, if five different flags are available.

OR

How many words each of 3 vowels and 2 consonants can be formed from the letters of the word **INVOLUTE** ?

17. If the 21^{st} & 22^{nd} terms in the expansion of $(1+x)^{44}$ are equal, then find the value of x.

18. The sums of n terms of 2 arithmetic progressions are in the ratio 5n + 4: 9n + 6. Find the ratio of their 18th terms.

19. Find the equation of the hyperbola with vertices at $(\pm 5, 0)$ and foci at $(\pm 7, 0)$.

20. Find the coordinates of the point which divides the line segment joining the points (4)

$(-2, 3, 5)$, & $(1, -6, 6)$ in the ratio $2:3$ internally.

21. Differentiate $|x|$ w. r. t. x using first principle.

22. The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing the English examination is 0.75, find the probability of passing the Hindi examination.

SECTION – C

23. Prove the following by using the principle of mathematical induction for all $n\in N$:

$$1+2+3+...+n<\frac{1}{8}(2n+1)^2.$$

24. Find the term independent of x in the expansion of $\left(x-\frac{1}{x}\right)^{12}$, where $x\ne 0$.

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

OR

If the p^{th} , q^{th} and r^{th} terms of a G.P. are a, b, c respectively. Prove that $a^{q-r} \cdot b^{r-p} \cdot c^{p-q} = 1.$

26. Find the area of the triangle formed by the midpoints of sides of the triangle whose vertices are $(2, 1), (-2, 3), (4, -3).$

OR

Find the equation of the line through the intersection of lines $3x + 4y = 7$ and $x - y + 2 = 0$ and whose slope is 5.

27. A rod of length 12 cm moves with its ends always touching the coordinate axes. Determine the equation of the locus of a point on the rod, which is 3cm from the end in contact with the $x-$axis.

28. Find the coordinates of the foot of the perpendicular from the origin to the line passing through the points $P(-9, 4, 5)$ and $Q(11, 0, -1)$.

29. Calculate the mean deviation about median for the following data:

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	6	7	15	16	4	2