Roll No. ______________

Code : 112012-041

Please check that this question paper contains **29** questions and **4** printed pages.

CLASS-XI
MATHEMATICS

Time Allowed : 3 Hrs. **Maximum Marks : 100**

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* *Please check that this question paper contains 4 printed pages.*
* *Code number given on the right side of the questionpaper should be written on the title page of the answer book by the candidate.*
* *Please check that this question paper contains 29 questions.*
* *Please write down the serial number of the question before attempting it.*
* *15 minutes time has been allotted to read this question paper. The question paper will be distributed at 9.15 a.m.*

General Instructions :

1. *Question paper consists of 29 questions divided in three sections.*
   Section A consists of 10 questions of 1 mark each.
   Section B consists of 12 questions of 4 marks each.
   Section C consists of 7 questions of 6 marks each.
2. *There is no overall choice. However, internal choices is given in four questions of 4 marks and two questions of 6 marks. In these cases, you have to attempt one out of the given two options.*
3. *Use of calculators is not permitted.*

Section-A

Q1. Let A = {5, 6}, B = {7, 8}. Find the number of relations from A to B.

Q2. Differentiate $\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2$ $w.r.t.\ 'x'$.

Q3. Evaluate $\lim_{x\to 0} \frac{e^{\frac{3x}{2}}-1}{x}$

Q4. Evaluate : $i^5 + i^6 + i^7 + i^8$

Q5. Combine the following two statements using "if and only if".
p : If the sum of digits of a number is divisible by 3, then the number is divisible by 3.
q : If a number is divisible by 3, then sum of its digits is divisible by 3.

Q6. Write the negation of the following statement :
p : There exists a rational number x such that $x^2 = 2$

Q7. Given two mutually exclusive events A and B such that $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{3}$, find $P(A \cup B)'$.

Q8. In a single throw of a die, find the probability of getting an even prime number.

Q9. Write the converse of the following statement :
p : If two integers a and b are such that $a > b$, then $a - b$ is always a positive integer.

Q10. Line through the points $(-2, 6)$ and $(4, 8)$ is perpendicuclar to the line through the points $(8, 12)$ and $(x, 24)$. Find the value of x.

Section-B

Q11. Prove that $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$

Q12. Find the square root of $-15 - 8i$.

Q13. Find the general solution of trigonometric equation :
$\cos 3x + \cos x - \cos 2x = 0$

OR

Draw the graph of $y = \cos x, -2\pi \leq x \leq 2\pi$

Q14. In a survey of 400 students in a school, 100 were listed as taking apple juice, 150 as taking orange juice and 75 were listed as taking both apple as well as orange juice. Find how many students were taking neither apple nor orange juice.

Q15. Find the domain and range of the function $f(x)$ given by

$$f(x) = \frac{x-3}{2x+1}$$

Q16. Prove $^{2n}C_n = \dfrac{2^n\,[1 \times 3 \times 5 \times \ldots \times (2n-1)]}{n!}$

OR

A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has (*i*) no girl (*ii*) atleast 2 boys and 2 girls.

Q17. Find the equation of the circle passing through the points (2, 3), (– 1, 1) and whose centre lies on the line $x - 3y - 11 = 0$.

OR

Find the equation of ellipse with major axis along the x-axis and passing through the points (4, 3) and (1, 4).

Q18. Find the sum to n terms of the series :

$3 \times 1^2 + 5 \times 2^2 + 7 \times 3^2 + \ldots$

Q19. Find the derivative of $f(x) = x + \dfrac{1}{x}$ from the first principle. Is $f'(x)$ defined at $x = 0$?

Q20. Three coins are tossed once. Find the probability of getting

(*i*) atmost two heads (*ii*) atleast two heads

(*iii*) exactly two heads.

Q21. Find the equation of the set of points P, the sum of whose distances from A (4, 0, 0) and B (– 4, 0, 0) is equal to 10.

Q22. Find the image of the point (3, 8) with respect to the line $x + 3y = 7$ assuming the line to be a plane mirror.

OR

Find the equation of a line drawn perpendicular to the line $\dfrac{x}{4} + \dfrac{y}{6} = 1$ through the point, where it meets y-axis.

Section-C

Q23. The coefficients of the $(r - 1)^{th}$, rth and $(r + 1)^{th}$ terms in the expansion of $(x + 1)^n$ are in the ratio 1 : 3 : 5, find n and r.

OR

Show that the coefficient of the middle term in the expansion of $(1 + x)^{2n}$ is is equal to the sum of the coefficients of two middle terms in the expansion of $(1 + x)^{2n-1}$.

Q24. Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9}

A = {1, 2, 3, 4}

B = (2, 4, 6, 8}

C = (3, 4, 5, 6}

Find (*i*) $(A \cup C)'$ (*ii*) $(B - C)'$ (iii) $(A \cap C)'$

Q25. In any Δ ABC, prove that $\dfrac{a^2 + b^2}{a^2 + c^2} = \dfrac{1 + \cos(A - B)\cos C}{1 + \cos(A - C)\cos B}$

Q26. If pth, qth and rth terms of a GP are a, b and c respectively

Prove : $a^{q-r} \times b^{r-p} \times c^{p-q} = 1$

OR

Sum of first three terms of a G.P. is 16 and the sum of the next three terms is 128. Determine the first term and the common ratio. Also find sum to n terms.

Q27. Prove by using principle of Mathematical Induction that $\forall n \in N$

$$\frac{1}{2 \times 5} + \frac{1}{5 \times 8} + \frac{1}{8 \times 11} + \ldots + \frac{1}{(3n - 1)(3n + 2)} = \frac{n}{6n + 4}$$

Q28. Solve the following system of inequalities graphically :

$4x + 3y \leq 60$

$y \geq 2x$

$x \geq 3$

$x, y \geq 0$

Also find vertices of solution region.

Q29. Calculate mean, variance and standard deviation for the following distribution.

Classes	30–40	40–50	50–60	60–70	70–80	80–90	90–100
frequency	3	7	12	15	8	3	2