STANDARD: XI A

DURATION: 3 Hrs

SUBJECT: MATHEMATICS

MARKS: 80

Name of the student: ----------

Class & Division: ----------------

GENERAL INSTRUCTIONS

1. This Question paper contains - five sections A, B, C, D, and E. Each section is compulsory.
2. Section A has 18 MCQs and 2 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/ Integrated units of assessment (4 marks each) with sub parts.

SECTION-A

(Multiple Choice Questions, Each Question carries 1 mark)

1. The number of elements in the power set P(A) of the set A = {a, b, c} is
   a) 4   b) 8   c) 2   d) 9

2. Empty set is a
   a) Finite set   b) Infinite set   c) Universal set   d) Unknown set

3. The Set of circles passing through origin is
   a) Finite set   b) Infinite set   c) Null set   d) None of these

4. Set A and B has 3 and 6 elements respectively. Find the minimum number of elements in $A \cup B$.
   a) 9   b) 8   c) 6   d) 3

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5. If $A \times B$ is an empty set, then which of the following is a null set?
   a) Only A
   b) Only B
   c) Both A and B
   d) Either A or B

6. Let $A = \{x: x \in Z$ and $x^2 \leq 4\}$ and $B = \{x: x \in R$ and $x^2 - 3x + 2 = 0\}$. Then
   a) $A = B$
   b) $A \neq B$
   c) $A \in B$
   d) $A \subseteq B$

7. Let $A = \{-2, -1, 0\}$ and $f(x) = 2x - 3$ where $x \in A$, then the range is
   a) $\{7, -5, -3\}$
   b) $\{-7, 5, -3\}$
   c) $\{-7, -5, -3\}$
   d) $\{-7, -5, 3\}$

8. Let $f(x) = \begin{cases} \frac{|x|}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$. Which function is this?
   a) Constant function
   b) Modulus function
   c) Identity function
   d) Signum function

9. If set A has 2 elements and set B has 4 elements, then the number of relations from A to B is
   a) 256
   b) 128
   c) 64
   d) 32

10. Find the radius of the circle in which a central angle of 60° intercept arc of length 37.4 cm ($\pi = \frac{22}{7}$).
    a) 35.7 cm
    b) 62.3 cm
    c) 12.4 cm
    d) 23.8 cm

11. The value of $2 \sin 75° \sin 15°$ is
    a) 1
    b) -1
    c) $\frac{1}{2}$
    d) $-\frac{1}{2}$

12. The degree measure of $\frac{11}{16}$ radian is
    a) 40.4°
    b) 39.6°
    c) 39.1°
    d) 39.3°

13. If a, b, c are real numbers such that $a \leq b$, $c < 0$, then
    a) $ac \leq bc$
    b) $ac < bc$
    c) $ac > bc$
    d) $ac \geq bc$

14. The fourth term of a GP is 2, then the product of first 7 terms is
    a) 7×2
    b) 2^7
    c) 7^2
    d) None of these

#x, $2x+2$, $3x+3$ are in GP ., then the fourth term of this sequence is
a) 27
b) −27
c) 13.75
d) −13.75

15. Solution set of the inequation $2x - 1 \leq 3$ and $3x + 1 \geq -5$ is
a) $(-2, 2)$
b) $[-2, 2]$
c) $(-\infty, -2) \cup (2, \infty)$
d) $(-\infty, -2] \cup [2, \infty)$

17. The value of $\sin 10° + \sin 50° - \sin 70°$ is
a) $\frac{\sqrt{3}}{2}$
b) $\frac{1}{2}$
c) 1
d) 0

18. If a, b, c are in GP., then $\frac{a-b}{b-c}$ is equal to
a) $\frac{a}{a}$
b) $\frac{a}{b}$
c) $\frac{a}{c}$
d) None of these

(Assertion Reasoning Questions, each question carries 1 mark)

a) Both A and R are correct, R is the correct explanation of A.
b) Both A and R are correct, R is not the correct explanation of A.
c) A is correct, R is incorrect.
d) A is incorrect, R is correct.

19. Assertion: The sum of the GP
$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots \text{ to } 12 \text{ terms} = \frac{4035}{2048}$$
Reason: For a GP , $S_n = \frac{a(1-r^n)}{1-r}$ (where $|r| < 1$)

20. Assertion: $\sin x$ is negative in third and fourth quadrant.
Reason: $\sin x$ increases from −1 to 0 in third quadrant decreases from 0 to −1 in fourth quadrant.

SECTION -B
(Very Short Answer Questions, Each Question carries 2 marks)

21. $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$. Find
a) $(A \cup B)'$
b) $B' - C'$

22. Let $A = \{1, 2\}$, $B = \{1, 2, 3, 4\}$ and $C = \{3, 4, 5\}$.
Verify $A \times (B \cap C) = (A \times B) \cap (A \times C)$.

23. Prove that $\dfrac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$.

24. Find the sum to n terms of the sequence $8, 88, 888, 8888 \ldots$

25. Which term of the sequence $\dfrac{1}{3}, \dfrac{1}{9}, \dfrac{1}{27}, \ldots$ is $\dfrac{1}{19683}$?

SECTION-C

(Short Answer Questions, Each Question carries 3 marks)

26. The sum of first three terms of a GP is 16 and the sum of the next three terms is 128. Determine the first term, the common ratio and the sum of n terms of the GP.

27. a) A man wants to cut three lengths from a single piece of board of length 91 cm. The second length is to be 3cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5 cm longer than the second?

    b) Solve for real x: $\dfrac{x}{2} \geq \dfrac{(5x-2)}{3} - \dfrac{(7x-3)}{5}$

28. Prove that $\cos^2 x + \cos^2\left(x + \dfrac{\pi}{3}\right) + \cos^2\left(x - \dfrac{\pi}{3}\right) = \dfrac{3}{2}$.

29. a) If $\tan x = \dfrac{3}{4}$, $\pi < x < \dfrac{3\pi}{2}$, find the value of $\sin\dfrac{x}{2}$, $\cos\dfrac{x}{2}$, $\tan\dfrac{x}{2}$.

    b) In a circle of diameter 40 cm, the length of a chord is 20 cm. Find the length of minor arc of the chord.

30. Prove that $\cos 20° \cos 40° \cos 60° \cos 80° = \dfrac{1}{16}$.

31. a) Find the domain and range of $f(x) = \sqrt{x - 1}$.

Let $A = \{9, 10, 11, 12, 13\}$ and $f: A \to N$ be defined by $f(n) =$ the highest prime factor of n. Find the range of f.

Let R be a relation on Z defined by $R = \{(a, b): a, b \in Z, a - b$ is an integer$\}$. Find the domain and range of R.

SECTION- D
(Long Answer Questions, Each Question carries 5 marks)

32. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{2, 4, 6, 8, 10\}$
$B = \{1, 2, 3, 4, 5, 6, 7\}$
a) Verify both De Morgan's laws.
b) Using Venn diagram, prove that
(i) $B - A = B \cap A'$.
(ii) $A - B = A - (A \cap B)$.

33. a) Show that $\tan 3x \tan 2x \tan x = \tan 3x - \tan 2x - \tan x$.
b) Show that $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$.
c) Find the value of $\tan(\frac{19\pi}{3})$.

34. a) If A and G be A.M and G.M., respectively between two positive numbers, prove that the numbers are $A \pm \sqrt{(A + G)(A - G)}$

b) If AM and GM of roots of a quadratic equation are 8 and 15 respectively, then obtain the quadratic equation.

35. a) Find the value of n so that $\dfrac{a^{n+1} + b^{n+1}}{a^n + b^n}$ may be the geometric mean between a and b
b) If the $4^{th}, 10^{th},$ and 16th terms of a GP are x, y, and z respectively. Prove that x, y, z are in GP

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36. In a school of Chandigarh, students of class XI were discussing about relations and functions. Two students Ankita and Babita formed two se... $A = \{1, 2, 3, 4, 5\}$ and $B = \{2, 4, 6\}$.

    Based on the above information, answer the following questions.

    a) Find $(A \times B)$.

    b) Find $(A - B) \times (B - A)$.

    c) A correspondence of elements from A to B is given as $\{(1, 2), (2, 2), (3, 4), (3, 6), (4, 4), (5, 6)\}$. Is it a function? Justify your answer.

    d) If the function $f: A \rightarrow B$ such that $(a, b) \in f$ and $a < b$ defined by $f = \{(1, 2), (x, 4), (2, 4), (4, y), (5, 6)\}$, then find x and y.

37. Rajiv constructs two right angled triangles in the fourth quadrant in... a way that the measure of the triangle gives $\cos A = \frac{4}{5}$ and $\cos B$ ... where $\frac{3\pi}{2} < A$ and $B < 2\pi$.

    a) Find $\cos(A + B)$ and $\tan(A + B)$.

    b) A horse is tied to a post by a rope. If the horse moves along a circular path, always keeping the rope tight and describes 88 metres when it traces 72° at the centre, find the length of the rope.

38. A person is entitled to a life time monthly payments. Which in each month is less by one-tenth than it was a month's before. He receives Rs. 5000 in the first month.

    Read the passage and answer the following questions:

    a) If successive terms of a GP, then first term and common ratio of GP

    b) Find the amount received in 3rd month

    c) Find the total amount received in 2nd month

    d) Find the amount received in 9th month

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