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SECTION-A

This section comprises multiple choice questions (MCQ's) of 1 mark each.

1. In set builder method the null set is represented by : (1)
- (a) $\{ \}$ (b) ϕ
(c) $\{x : x \neq x\}$ (d) $\{x : x = x\}$
2. If $A = \{1, 3, 5, B\}$, $B = \{2, 4\}$, then which one is false? (1)
- (a) $B \subset A$ (b) $\{4\} \subset B$
(c) $B \in A$ (d) $\{1, 3, B\} \subset A$
3. If $A = \{p, q, r\}$, then number of proper subsets of A are : (1)
- (a) 8 (b) 7
(c) 6 (d) 9
4. Domain of the function $f(x) = \frac{1}{2x+3}$ is : (1)
- (a) $\mathbb{R}$ (b) $\mathbb{R} - \{3\}$
(c) $\left\{-\frac{3}{2}\right\}$ (d) $\mathbb{R} - \left\{-\frac{3}{2}\right\}$
5. Let $A = \{1, 2, 3\}$, $B = \{4, 6, 9\}$ and R is a relation from A to B defined by $R = \{(x, y) : x > y\}$, then the range of R is : (1)
- (a) $\{1, 4, 6, 9\}$ (b) $\{4, 6, 9\}$
(c) $\{1\}$ (d) ϕ
6. If $A = \{1, 2, 4\}$, $B = \{2, 4, 5\}$, $C = \{2, 5\}$, then $(A - B) \times (B - C)$ is : (1)
- (a) $\{(1, 2), (1, 5), (2, 5)\}$ (b) $\{(1, 4)\}$
(c) $\{(1, 5)\}$ (d) None of these
7. Which one is incorrect : (1)
- (a) $\sin x = -\frac{1}{5}$ (b) $\cos x = 1$
(c) $\sec x = \frac{1}{2}$ (d) $\tan x = 25$

8. If $(\alpha + \beta) = \frac{\pi}{4}$, then the value of $(1 + \tan \alpha)(1 + \tan \beta)$ is :

- (a) 1 (b) 2
(c) -2 (d) None of these

9. The value of $\tan 1^\circ \cdot \tan 2^\circ \cdot \tan 3^\circ \dots \tan 89^\circ$ is :

- (a) -1 (b) 0
(c) 1 (d) $\frac{1}{\sqrt{3}}$

10. The value of $(1 + i)^4 + (1 - i)^4$ is :

- (a) 8 (b) -8
(c) 4 (d) -4

11. If $\frac{c+i}{c-i} = a + ib$; $a, b, c \in \mathbb{R}$, then $a^2 + b^2$:

- (a) i (b) c^2
(c) 1 (d) -1

12. If $z_1 = \sqrt{3} + i\sqrt{3}$, $z_2 = \sqrt{3} + i$, then the point $\frac{z_1}{z_2}$ lies in :

- (a) 1st quadrant (b) 2nd quadrant
(c) 3rd quadrant (d) 4th quadrant

13. If the conjugate of $(x + iy)(1 - 2i)$ is $(1 + i)$, then :

- (a) $x = \frac{1}{5}$ (b) $y = \frac{3}{5}$
(c) $x + iy = \frac{1-i}{1-2i}$ (d) $x - iy = \frac{1-i}{1+2i}$

14. Solution set of $\frac{x-3}{x+5} < 0$ is :

- (a) $(-\infty, -5)$ (b) $(-5, 3)$
(c) $(\infty, 3)$ (d) $(0, 3)$

15. If $5x - 4 < 2x + 13$, $x \in \mathbb{N}$, then x belongs to :

- (a) $\{1, 2, 3, 4\}$ (b) $\{0, 1, 2, 3\}$
(c) $\{1, 2, 3, 4, 5\}$ (d) $\{0, 1, 2, 3, 4, 5\}$

16. Solution set for inequality $x - 1 \leq 5; x \in \mathbb{Z}$: (1)
- (a) $(-\infty, 6)$ (b) $(6, \infty)$
- (c) $\{..., -2, -1, 0, 1, 2, 3, 4, 5, 6\}$ (d) $\{..., -2, -1, 0, 1, 2, 3, 4\}$ $15! / (5! \cdot 10!) = 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 = 1307674368000$
17. If ${}^{15}P_r = 2730$, then value of r is : (1)
- (a) 5 (b) 7
- (c) 3 (d) 12
18. If ${}^{18}C_r = {}^{18}C_{r+2}$, then value of rC_5 is : (1)
- (a) 18 (b) 36
- (c) 56 (d) 28

Question number 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (a), (b), (c) and (d) as given below :

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.
19. **Assertion (A)** : The degree measure corresponding to -4 radian is $-229^\circ 5' 27''$. (1)
- Reason (R)** : The degree measure of a given radian measure is equal to $\frac{180}{\pi}$ Radian measure.
20. **Assertion (A)** : The number of ways of distribution of 10 identical balls in 4 distinct boxes such that no box is empty is 9C_3 . (1)
- Reason (R)** : The number of ways of choosing any 3 places from 9 different places is 9C_3 .

SECTION-B

This section comprises of 5 very short answer (VSA) type questions of 2 marks each.

21. If $A = \{4, \{2, 3\}\}$, then write the power set of A . (2)
22. If a relation R from a set $A = \{2, 3, 4, 5\}$ to a set $B = \{3, 6, 7, 10\}$ is defined as $R = \{(x, y); x \text{ divides } y, x \in A, y \in B\}$. write the roster form of R . (2)

23. Find the domain of the real function $f(x) = \sqrt{x^2 - 9}$. (2)

OR

Find the range of the function $f(x) = (x^2 + 2)$

24. Prove that : $\frac{\cos 54^\circ + \sin 54^\circ}{\sin 36^\circ + \cos 36^\circ} = 1$ (2)

OR

Prove that : $\frac{\cos(\pi + A) \cdot \cos(-A)}{\sin(\pi - A) \cdot \cos\left(\frac{\pi}{2} + A\right)} = \cot^2 A$

25. Find the multiplicative inverse of $(7 - 24i)$ (2)

SECTION-C — (11)

This section comprises of 6 short answer (SA) type questions of 3 marks each.

26. For set A and B, using properties, prove that (3)

$$(A \cup B)' = A' \cap B'$$

OR

If A = set of all letters in the word "ARITHMATIC"

B = set of all letters in the word "MATHEMATICS".

Then find :

(a) $A \cap B$

(b) $A - B$

(c) $A \cup B$

27. Draw the graph of greatest integer function and write its domain and range. (3)

For Visually Impaired Students

If $f = \{(1, 1), (2, 3), (0, -1), (-1, -3)\}$ is a function from Z to Z s.t. $f(x) = ax + b$, find value of a and b.

28. Write $\left(\frac{\cos \alpha - i \sin \alpha}{\cos \beta + i \sin \beta}\right)$ into $x + iy$ form. (3)

OR

If $\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is a real number then find the real value of θ .

29. Solve the inequality :

$$\frac{x}{2} \geq \frac{5x-2}{3} - \frac{7x-3}{5}$$

30. How many words can be formed from the letters of the word 'PERMUTATIONS' so that: (3)

(i) the vowels always come together

(ii) the consonants always come together

31. Ritu has 5 friends. In how many ways, can she invite one or more to her birthday party? (3)

OR

Find the number of integer greater than 6000 that can be formed with the digits 3, 5, 6, 7.

SECTION-D

(16)

This section comprises of 4 long answer (LA) type questions of 5 marks each.

32. Draw the graph of the function $f(x)$, (5)

$$f(x) = \begin{cases} 1+2x & , x < 0 \\ 3+5x & , x \geq 0 \end{cases}$$

Also find the range of $f(x)$ and domain of $f(x)$.

For Visually Impaired Students

Find the domain and range of the function $f(x)$,

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

33. Prove that : (5)

$$\cos \theta \cdot \cos(60^\circ - \theta) \cdot \cos(60^\circ + \theta) = \frac{1}{4} \cos 3\theta$$

OR

Prove that :

$$\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$$

34. If $x + iy = \frac{3}{2 + \cos \theta + i \sin \theta}$, then prove that $(x - 1)(x - 3) + y^2 = 0$

(5)

OR

If $f(z) = \frac{7 - z}{1 - z^2}$, where $z = 1 + 2i$, then show that $|f(z)| = \frac{|z|}{2}$

35. There are 9 points in a plane no three of which are in the same straight line except 4 points which are collinear. Find :

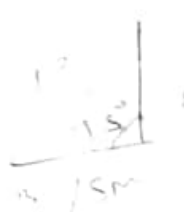
- the number of lines obtained from the pairs of these points.
- the number of triangles that can be formed with vertices as these points.

SECTION-E

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This section comprises of 3 Case Study/Passage-Based questions of 4 marks each with two sub-parts. First two Case Study questions have three sub-parts (I), (II), (III) of marks 1, 1, 2 respectively. The third Case Study questions has two sub-parts (I) and (II) of marks 2 each.

36. While playing a park, two friends Nandini and Dimpi observe a vertical pole in park. A wire is tied from top of pole to a point on ground level. Nandini asked Dimpi some mathematics related questions as Dimpi is a class XI student and very intelligent. Using some tools she measure the distance of point at ground where wire is tied as 15 m and angle between wire and ground level is 75° .



Based on above information, answer the following questions :

- What is the value of $\cot 75^\circ$?
- What is the height of pole?
- What is the length of wire?

(1)

(1)

(2)

OR

- What is the value of $\tan 75^\circ$?

37. Deepak and Neeraj are friends. They are fond of collecting different and beautiful ball pens and gel pens respectively. If A is the set of ball pens that Deepak having and B is the set of gel pens that Neeraj having. It is given that $n(A) + n(B) = 12$ and the number of elements of power set of A is 16 times the number of elements of power set of B.



$$(2x - iy)(1 + 7i)$$

$$2x + 7x^2 - iy + 7iy$$

$$2x + 7x^2 + 6iy$$

Based on above information, answer the following questions :

- Find the number of elements in set A.
- Find the number of elements in set B.
- If $B \subset A$ then find $n(A \cap B)$.

OR

- Find $n(A - B)$; if $B \subset A$

38. Megha is a psychology student and now-a-days she is learning about Intelligence Quotient (IQ). She calculates the result as follows :

$$I.Q. = \left(\frac{M.A.}{C.A.} \right) \times 100$$

where M.A. is mental age and C.A. is chronological age.



Based on above information, answer the following questions :

- Find the range of Mental Age (M.A.) for a group of 12 years old children if $80 \leq I.Q. \leq 140$ (2)
- Find the range of Intelligence Quotient (I.Q.) of a group of children with age of 13 years, if $12 \leq M.A. \leq 18$ (2)