



विद्या सर्वार्थ साधिका

ANANDALAYA
ANNUAL EXAMINATION

Class: XI

Subject: Mathematics
Date : 22-02-2023

M.M : 80
Time : 3 Hours

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 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/passage based/integrated units of assessment (4 marks each) with sub parts.

SECTION A

(Multiple Choice Questions) Each question carries 1 mark

1. Set builder form of $A = \{0, 3, 8, 15, 24\}$ will be _____. (1)
A) $\{x: x = n^2 - 1, n \in N \text{ and } n \leq 5\}$ B) $\{x: x = n^2 - 1, n \in N \text{ and } n < 5\}$
C) $\{x: x = n^2 - 1, n \in W \text{ and } n \leq 5\}$ D) $\{x: x = n^2 - 1, n \in N\}$
2. $A = \{4, 5, 9\}$ and $B = \{4, 6, 8\}$ then express a relation R in $A \times B$ if $a < b$ where $a \in A, b \in B$. (1)
A) $\{(4, 6), (4, 8), (5, 6)\}$ B) $\{(4, 6), (4, 8), (5, 6), (5, 8)\}$
C) $\{(4, 4), (4, 8), (5, 6), (5, 8)\}$ D) $\{(6, 4), (8, 4), (6, 5), (8, 5)\}$
3. The Domain of the relation $R = \{(x, y): y = x - 1\}$ is $\{x: 0 \leq x \leq 4, x \in N\}$. The range of $R =$ _____. (1)
A) $\{-1, 0, 1, 2, 3, 4\}$ B) $\{-1, 0, 1, 2, 3\}$ C) $\{1, 2, 3, 4\}$ D) $\{0, 1, 2, 3\}$
4. The value of $\frac{\tan 69^\circ + \tan 66^\circ}{1 - \tan 69^\circ \cdot \tan 66^\circ} =$ _____. (1)
A) 1 B) -1 C) $\sqrt{3}$ D) $\frac{1}{\sqrt{3}}$
5. The value of $2i^2 + 6i^3 + 3i^{16} - 6i^{19} + 4i^{25} =$ _____. (1)
A) $1 + 3i$ B) $5 + 3i$ C) $1 + 4i$ D) $1 + 16i$
6. The solution of $2(2x + 3) - 10 < 6(x - 2) =$ _____. (where $x \in R$). (1)
A) $x < 4$ B) $x > 4$ C) $x < -4$ D) $x < 8$
7. How many different words can be formed with the letters of the word *BHARAT* ? (1)
A) 720 B) 240 C) 360 D) 120
8. How many three digit odd numbers can be formed from the digits 1, 2, 3, 4, 5, 6 when repetition of digits is not allowed? (1)
A) 60 B) 120 C) 720 D) 125
9. The 10th term of the GP $\frac{1}{32}, \frac{1}{16}, \frac{1}{8}, \dots$ is _____. (1)
A) 64 B) 32 C) 516 D) 16
10. Find the AM of $(a + b)^2$ and $(a - b)^2$. (1)
A) $a^2 + b^2$ B) $4ab$ C) $2(a^2 + b^2)$ D) $a^2 - b^2$

11. Find the x –intercept and y –intercept cut off by the line $2x - y + 16 = 0$ on the coordinate axes. (1)
 A) 8 and 16 B) -8 and -16 C) -8 and 16 D) -16 and 8
12. The angle between the lines $x + 2y - 7 = 0$ and $3x + y + 9 = 0$ is _____. (1)
 A) 30° B) 45° C) 60° D) 90°
13. The equation of the circle with centre $(3, -2)$ and touching the x – axis is _____. (1)
 A) $(x - 3)^2 + (y + 2)^2 = 9$ B) $(x + 2)^2 + (y - 3)^2 = 9$
 C) $(x - 3)^2 + (y + 2)^2 = 4$ D) $(x - 3)^2 + (y + 2)^2 = 0$
14. The coordinates of the foot of the perpendicular from the point $(1, 2, 3)$ to the y – axis is _____. (1)
 A) $(0, 2, 0)$ B) $(1, 2, 0)$ C) $(1, 0, 0)$ D) $(0, 1, 3)$
15. The value of $\lim_{\theta \rightarrow 0} \frac{1 - \cos 6\theta}{1 - \cos 4\theta} =$ _____. (1)
 A) $\frac{4}{9}$ B) $\frac{3}{2}$ C) $\frac{2}{3}$ D) $\frac{9}{4}$
16. The derivative of $y = \frac{\log x}{x} =$ _____. (1)
 A) $\frac{1 - \log x}{x}$ B) $\frac{1 - \log x}{x^2}$ C) $\frac{\log x}{x^2}$ D) $\frac{-\log x}{x^2}$
17. If E and F are events such that $P(E) = \frac{1}{4}$, $P(F) = \frac{1}{2}$ and $P(E \text{ and } F) = \frac{1}{8}$, then $P(E \text{ or } F) =$ _____. (1)
 A) $\frac{1}{8}$ B) $\frac{5}{8}$ C) $\frac{7}{8}$ D) $\frac{1}{4}$
18. Find the modulus of the complex number : $1 + \sqrt{3}i$. (1)
 A) 4 B) 1 C) 2 D) 3

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- (A) Both A and R are true and R is the correct explanation of A.
 (B) Both A and R are true but R is not the correct explanation of A.
 (C) A is true but R is false.
 (D) A is false but R is true.

19. **Assertion (A):** $A = \{-2, -1, 0, 1\}$ $B = \{0, 1, 3\}$ then $n(A \times B) = 7$. (1)
Reason (R): Let $n(A)$ represents the number of elements in set A. Then $n(A \times B) = n(A) \times n(B)$
20. **Assertion (A):** The sum of an infinite G.P. is 6. If its first term is 2, find its common ratio is $\frac{2}{3}$. (1)
Reason (R) : Sum to infinity of a GP is given by the formula $S = \frac{a}{1-r}$ where a is first term and r is the common ratio.

SECTION B

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

21. Find the domain and range of $R = \{(2x + 3, 1 + x) : 3 \leq x \leq 5, x \in N\}$. (2)
22. Solve for the system of inequalities: $4x - 12 \geq 0, 2x - 7 \leq 5$. (2)
23. In how many ways a committee consisting of 3 men and 2 women, can be chosen from 7 men and 5 women? (2)

OR

If $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$, find x.

24. Using distance formula, check whether the points $P(1, 2, 3)$, $Q(-1, -1, -1)$, and $R(3, 5, 7)$ are collinear or not. (2)

- 25 Find the equation of the right bisector of the line segment joining A (1, 1) and B (2, 3). (2)

OR

If the line $\frac{x}{a} + \frac{y}{b} = 1$ passes through the points (12, -15) and (8, -9), find the values of a and b .

SECTION C

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

- 26 If $U = \{x: x \in Z \text{ and } -3 \leq x \leq 7\}$ $A = \{x: x \in W \text{ and } x^2 - 4x + 3 = 0\}$,
 $B = \{x: x \in Z \text{ and } \frac{-1}{2} < x < \frac{9}{2}\}$ $C = \{x: x \in Z \text{ and } x^2 \leq 4\}$.
Find i) $B - A$ ii) $(B \cap A)^c$ iii) $(A \cup C)^c$ (3)

- 27 Show that $\sin \alpha + \sin\left(\alpha + \frac{2\pi}{3}\right) + \sin\left(\alpha + \frac{4\pi}{3}\right) = 0$ (3)

OR

Show that $\frac{\cos 3A + \sin 3A}{\cos A - \sin A} = 1 + 2 \sin 2A$

- 28 If $z = x + iy$ and $z^2 = a + ib$ where a, b, x, y are real numbers, show that $2x^2 = \sqrt{a^2 + b^2} + a$. (3)

- 29 Expand using binomial theorem: $\left(x - \frac{1}{2x}\right)^5$. (3)

OR

Simplify: $(x + \sqrt{x-1})^6 + (x - \sqrt{x-1})^6$

- 30 Using first principle, find the derivative of $y = \operatorname{cosec} x$. (3)

- 31 A bag contains 8 red balls and 5 white balls. Three balls are drawn at random. Find the probability that, i) all the three balls are white. ii) one ball is red and two balls are white. (3)

OR

In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that (i) The student opted for NCC or NSS. (ii) The student has opted neither NCC nor NSS (iii) The student has opted NSS but not NCC

SECTION D

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

- 32 If $\sin \alpha = \frac{15}{17}$ and $\cos \beta = \frac{12}{13}$, α and β are positive and acute, find the values of $\sin(\alpha + \beta)$ and $\cos(\alpha - \beta)$. (5)

OR

Prove that: $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$

33. Among 20 members of a cricket club, there are two wicket-keepers and five bowlers. In how many ways can eleven members be chosen so as to include only one of the wicket-keepers and at least three bowlers? (5)

34. Find the equation of the circle passing through the points (2, 3) and (-1, 1) and whose centre is on the line $x - 3y - 11 = 0$. (5)

OR

The cable of a uniformly loaded suspension bridge hangs in the form of a parabola. The roadway which is horizontal and 100 m long is supported by vertical wires attached to the cable, the longest wire being 30 m and the shortest being 6 m. Find the length of a supporting wire attached to the roadway 18 m from the middle.

- 35 Find the mean and variance for the following frequency distribution : (5)

CLASSES	0- 10	10- 20	20 -30	30- 40	40-50
FREQUENCY	5	8	15	16	6

OR

Find the mean deviation from the mean for the following data:

CLASSES	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
FREQUENCY	2	3	8	14	8	3	2

SECTION E

- 36 How many words can be formed from the letters of the word DAUGHTER?
 i) taking all the letters together (1)
 ii) beginning with D and ending with R (1)
 iii) Vowels being always together. (1)

OR

- iii) Vowels occupying even places. (2)

- 37 In a group of 100 students, 65 like to play cricket, 40 like to play tennis and 55 like to play volleyball. All of them like to play at least one of three games. If 25 like to play both cricket and tennis, 24 like to play both tennis and volleyball, and 22 like to play both cricket and volleyball.

Use the concept of set theory and answer the following.

- i) If A, B, C are three non -empty sets then, $n(A \cup B \cup C) = \underline{\hspace{2cm}}$ (1)
 ii) How many like to play all the three games? (1)
 iii) How many like to play cricket only? (2)

OR

- iii) How many like to play tennis only?

- 38 Chetan Solanki, a professor at IIT Bombay has been on an “energy swarajyatra” since 2020 on a bus designed by him to sustain an 11 year mission that he intends to spend entirely in vehicle powered by solar energy. On 12th Dec 2022, he visited NDDDB also. He said, because of your lack of awareness, energy illiteracy is pushing your kids into a dangerous world where life would be extremely difficult. There will be severe shortage of food and **drinking water**.....

It is found in most of the societies water consumption is too high. Use the concept of progression and answer the following.

A water tank had 1778 litres of water. The volume of the water decreased by 14, 28, and 56 litres over the next three days respectively. Given that the water volume decreases in the same pattern.

- i) The sequence 14, 28, 56..... form a GP with common ratio _____ (1)
 ii) Amount of water in the tank at the end of 5th day = _____ litres. (1)

OR

- ii) Amount of water consumed on 6th day = _____ litres. (1)
 iii) How long will it take the tank to be empty? (2)