CBSE SAMPLE PAPER - 06

Class 11 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 80**

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

1. Let f : R $\rightarrow$ R be defined by $f(x) = \begin{cases} 2x : x > 3 \\ x^2 : 1 < x \leq 3 \\ 3x : x \leq 1 \end{cases}$ **[1]**

   Then f (–1) + f (2) + f (4) is

   a) 5 b) 9

   c) none of these d) 14

2. The value of $(1 + i)^4 + (1 - i)^4$ is **[1]**

   a) -4 b) 8

   c) 4 d) -8

3. Solutions of the inequalities comprising a system in variable x are represented on number lines as given below, then **[1]**

   a) x $\in$ [– 3, 1] b) x $\in$ (–∞, – 4) $\cup$ [3, ∞)

   c) x $\in$ [– 4, 3] d) x $\in$ (– ∞, – 4] $\cup$ [3, ∞)

4. Two cards are drawn one by one without replacement from a deck of 52 cards. The probability that the second card is higher in rank than the first card, is: **[1]**

   (Ranks in increasing order can be taken from Ace to King.)

   a) $\frac{8}{17}$ b) $\frac{16}{17}$

   c) $\frac{9}{17}$ d) $\frac{1}{17}$

5. Which of the following sets is a finite set? **[1]**

a) $B = \{x : x \in Z \text{ and } x^2 \text{ is even}\}$

b) All of these

c) $A = \{x : x \in Z \text{ and } x^2 - 5x + 6 = 0\}$

d) $D = \{x : x \in Z \text{ and } x > -10\}$

6. $\lim_{x \to \pi/3} \frac{\sin\left(\frac{\pi}{3} - x\right)}{2\cos x - 1}$ is equal to **[1]**

a) $\sqrt{3}$

b) $\frac{1}{2}$

c) $\frac{1}{\sqrt{3}}$

d) $\sqrt{5}$

7. $\sum_{r=0}^{n} 4^r . {}^n C_r$ is equal to **[1]**

a) 6^n

b) 5^{-n}

c) 4^n

d) 5^n

8. The standard deviation of the observations 5, 5, 5, 5, 5 is: **[1]**

a) 20

b) 5

c) 0

d) 25

9. Sum of three numbers in a G.P. is 21. If 2 is subtracted from first term and 1 is subtracted from third term, the new numbers are in A.P. The largest of the original numbers is: **[1]**

a) 18

b) 15

c) 9

d) 12

10. In a $\triangle$ ABC, it is given that $\angle A : \angle B : \angle C = 3 : 4 : 5$, then a : c = ? **[1]**

a) 3 : 5

b) $\sqrt{3} : \sqrt{5}$

c) $3 : (\sqrt{2} + 1)$

d) $2 : (\sqrt{3} + 1)$

11. The area of triangle formed by the lines y = x, y = 2x and y = 3x + 4 is **[1]**

a) 8

b) 7

c) 9

d) 4

12. $\lim_{\theta \to \pi/2} \frac{1 - \sin\theta}{(\pi/2 - \theta)\cos\theta}$ is equal to **[1]**

a) -1

b) 1

c) $-\frac{1}{2}$

d) $\frac{1}{2}$

13. If $\frac{(a^2+1)^2}{2a-i} = x + iy$, then $x^2 + y^2$ is equal to **[1]**

a) $\frac{(a^2+1)^4}{4a^2+1}$

b) $\frac{(a^2-1)^2}{(4a^2-1)^2}$

c) None of these

d) $\frac{(a+1)^2}{4a^2+1}$

14. If $f(x) = \frac{4x(x^2+1)}{x^2+(x^2+1)^2}, x \geq 0$ then range of f(x) is: **[1]**

a) $\left(0, \frac{8}{5}\right]$

b) $\left[0, \frac{8}{5}\right]$

c) $\left(2, \frac{8}{5}\right]$

d) $\left[\frac{8}{5}, \infty\right) \cup \{0\}$

15. The number of lines that are parallel to 2x + 6y – 7 = 0 and have an intercept 10 units between the coordinate **[1]**

axis is :

a) 3 b) 2

c) 4 d) 1

16. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$, then $\sum_{r=0}^{n} \frac{r}{{}^nC_r}$ equals **[1]**

a) $\frac{1}{2}na_n$ b) $(n - 1)a_n$

c) None of these d) $n\ a_n$

17. $\lim_{x \to 0} \frac{(1-\cos 2x)\sin 5x}{x^2 \sin 3x}$ **[1]**

a) $\frac{5}{6}$ b) $\frac{3}{10}$

c) $\frac{6}{5}$ d) $\frac{10}{3}$

18. The solution set for (x + 3) + 4 > -2x + 5: **[1]**

a) none of these b) $\left(\frac{-2}{3}, \infty\right)$

c) $(-\infty, -2)$ d) $(2, \infty)$

19. **Assertion (A):** If sin x = $-\frac{1}{3}$, then cos x = $\frac{2\sqrt{2}}{3}$ **[1]**

Reason (R): If the value of cos x is -ve and sin x is -ve then x $\in \left[\frac{3\pi}{2}, 2\pi\right]$

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.

20. **Assertion (A):** The Total no. words with letters of the word civilization (all taken at a time) is 19958393. **[1]**

Reason (R): The number of permutation of n distincts objects (r taken at a time) is ${}^np_r$.

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.

Section B

21. Prove that: cos A + cos 3A + cos 5A + cos 7A = 4 cos A cos 2A cos 4A. **[2]**

22. If X and Y are two sets such that X ∪ Y has 18 elements, X has 8 elements and Y has 15 elements ; how many elements does X ∩ Y have? **[2]**

23. If the letters of the word **MISSISSIPPI** are written down at random in a row, what is the probability that four S's come together. **[2]**

OR

A die is thrown twice. Each time the number appearing on it is recorded. Describe the following events:

i. A = Both numbers are odd.

ii. B = Both numbers are even.

iii. C = Sum of the numbers is less than 6

Also, find A ∪ B , A ∩ B, A ∪ C , A ∩ C. Which pairs of events are mutually exclusive?

24. Find the obtuse angle between the lines x - 2y + 3 = 0 and 3 x + y - 1 = 0. **[2]**

25. A and B are two sets given in such a way that $(A \times B)$ contains 6 elements. If three elements of $(A \times B)$ are **[2]**

(1, 3), (2, 5) and (3, 3), find its remaining elements.

Section C

26. If $(x + iy)^{1/3} = a + ib$, where x, y, a, b $\in$ R, then show that $\frac{x}{a} - \frac{y}{b} = -2(a^2 + b^2)$. **[3]**

27. Solve $5x - 3 < 3x + 1$ when **[3]**

i. x is a real number

ii. x is an integer

iii. x is a natural number

OR

Solve $\frac{8x^2+16x-51}{2x^2+5x-12} > 3$

28. Using binomial theorem, expand: $\left(x^2 - \frac{2}{x}\right)^7$. **[3]**

OR

Evaluate: $(\sqrt{3}+1)^5 - (\sqrt{3}-1)^5$

29. Find the point in yz-plane which is equidistant from the points A(3, 2, -1), B(1, -1, 0) and C(2, 1, 2). **[3]**

OR

Find the coordinates of a point on y-axis which are at a distance of $5\sqrt{2}$ from the point P(3, -2, 5).

30. A basket contains 20 apples and 10 oranges out of which 5 apples and 3 oranges are defective. If a person takes out 2 at random, what is the probability that either both are apples or both are good? **[3]**

31. Let $f : R \rightarrow R : f(x) = 2^x$. Find **[3]**

i. range (f)

ii. $\{x : f(x) = 1\}$.

iii. Find out whether $f(x + y) = f(x) \cdot f(y)$ for all x, y $\in$ R.

Section D

32. While calculating the mean and variance of 10 readings, a student wrongly used the reading 52 for the correct reading 25. He obtained the mean and variance as 45 and 16 respectively. Find the correct mean and the variance. **[5]**

33. In a survey of 100 students, the number of students studying the various languages were found to be: English only 18, English but not Hindi 23, English and German 8, English 26, German 48, German and Hindi 8, no language 24. Find the number of students who were studying (i) Hindi (ii) English and Hindi (iii) English, Hindi and German. **[5]**

OR

A school awarded 58 medals in three sports, namely 38 in football; 15 in basketball and 20 in cricket. If 3 students got medals in all the three sports, how many received medals in exactly two sports?

34. Find the equation of the hyperbola whose vertices are at (0 ± 7) and foci at $\left(0, \pm\frac{28}{3}\right)$. **[5]**

OR

Show that the equation $x^2 - 2y^2 - 2x + 8y - 1 = 0$ represents a hyperbola. Find the coordinates of the centre, lengths of the axes, eccentricity, latusrectum, coordinates of foci and vertices and equations of directrices of the hyperbola.

35. Differentiate If $y = \sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}}$ show that $\frac{dy}{dx} = (\sec x \tan x + \sec x)$ **[5]**

Section E

36. **Read the text carefully and answer the questions:** **[4]**

A sequence of non-zero numbers is said to be a geometric progression, if the ratio of each term, except the first one, by its preceding term is always constant.

Rahul being a plant lover decides to open a nursery and he bought few plants with pots. He wants to place pots in such a way that number of pots in first row is 2 , in second row is 4 and in third row is 8 and so on ... .

(i) If Rahul wants to place 510 pots in total, then the total number of rows formed in this arrangement is

a) 5 b) 7

c) 9 d) 8

(ii) Total number of pots upto 10th row is

a) 2046 b) 1024

c) 1046 d) 1023

(iii) The difference in number of pots placed in 7th row and 5th row is

a) 50 b) 96

c) 90 d) 86

OR

The number of pots in 8th row is

a) 300 b) 156

c) 456 d) 256

37. **Read the text carefully and answer the questions:** **[4]**

A state cricket authority has to choose a team of 11 members, to do it so the authority asks 2 coaches of a government academy to select the team members that have experience as well as the best performers in last 15 matches. They can make up a team of 11 cricketers amongst 15 possible candidates. In how many ways can the final eleven be selected from 15 cricket players if:

(i) One of them, who is in bad form, must always be excluded

a) 480 b) 364

c) 1365 d) 640

(ii) Two of them being leg spinners, one and only one leg spinner must be included?

a) ${}^{2}C_{1} \times {}^{13}C_{10}$ b) ${}^{1}C_{2} \times {}^{13}C_{10}$

c) ${}^{2}C_{10} \times {}^{13}C_{10}$ d) ${}^{2}C_{1} \times {}^{10}C_{13}$

(iii) If there are 6 bowlers, 3 wicket-keepers, and 11 batsmen in all. The number of ways in which a

A team of 4 bowlers, 2 wicket-keepers, and 5 batsmen can be chosen.

a) ${}^{6}C_2 \times {}^{3}C_5 \times {}^{11}C_4$

b) ${}^{6}C_2 \times {}^{3}C_4 \times {}^{11}C_5$

c) ${}^{6}C_2 \times {}^{3}C_1 \times {}^{11}C_5$

d) ${}^{6}C_2 \times {}^{3}C_4 \times {}^{11}C_5$

OR

There is no restriction:

a) 2365

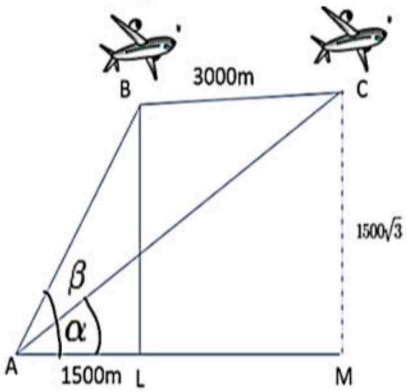
b) 1375

c) 1365

d) 1465

38. **Read the text carefully and answer the questions:** **[4]**

The angle of elevation of an airplane from a point A on the ground is α. After a flight of 15 seconds, the angle of elevation is β. The airplane is flying at a constant height of $1500\sqrt{3}\ m$. Distance between two positions of plane is 3000m. Again, distance AL = 1500m.



(i) Find the value of sin β.

(ii) Find the value of sin α.