

J B Academy, Ayodhya
Annual Examination 2024-25

Class - XI

Sub- Mathematics

Time : 3 hrs.

M.M : 80

General Instructions:

1) Question paper consists of five sections Sec-A, Sec-B, Sec-C, Sec-D and Sec-E.

2) All questions are compulsory where as internal choices have been provided

Section- A (Each of 1 mark)

- 1) For any set A, (A') is equal to
a) A' b) A c) \emptyset d) none of these
- 2) Let U be the universal set containing 700 elements. If A, B are sub-sets of U such that $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$. Then $n(A' \cap B') =$
a) 400 b) 600 c) 300 d) none of these
- 3) If $A = \{1, 2, 4\}$, $B = \{2, 4, 5\}$, $C = \{2, 5\}$, then $(A - B) \times (B - C)$ is
a) $\{(1, 2), (1, 5), (2, 5)\}$ b) $\{(1, 4)\}$ c) $(1, 4)$ d) none of these
- 4) If R is a relation from a finite set A having m elements to a finite set B having n elements, then the no of relations from A to B is
a) 2^{mn} b) $2^{mn} - 1$ c) n^2 d) n^n
- 5) If $\tan x = x - \frac{1}{4x}$, then $\sec x - \tan x$ is equal to
a) $-2x, \frac{1}{2x}$ b) $-\frac{1}{2x}, 2x$ c) $2x$ d) $2x, \frac{1}{2x}$
- 6) If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$ and $z = r \cos \theta$ then $x^2 + y^2 + z^2$ is independent of
a) θ, ϕ b) r, θ c) r, ϕ d) r
- 7) If $-3x + 17 < -13$, then
a) $X \in (10, \infty)$ b) $x \in [10, \infty)$ c) $x \in (-\infty, 10]$ d) none of these
- 8) If sum of p terms of an A.P is q and the sum of q terms is p, then the sum of p + q terms will be
a) 0 b) $p - q$ c) $p + q$ d) $-(p + q)$
- 9) If the sum of n terms of an A.P be $3n^2 - n$ and its common difference is 6, then its first term will be
a) 0 b) 3 c) 1 d) 4
- 10) A line passes through the point (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is
a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) 1 d) $\frac{4}{3}$
- 11) The no of real values of K for which the lines $x - 2y + 3 = 0$, $Kx + 3y + 1 = 0$ and $4x - Ky + 2 = 0$ are concurrent is
a) 0 b) 1 c) 2 d) none of these
- 12) The eccentricity of the ellipse $4x^2 + 9y^2 = 36$ is
a) $\frac{1}{2\sqrt{3}}$ b) $\frac{1}{\sqrt{3}}$ c) $\frac{\sqrt{5}}{3}$ d) $\frac{\sqrt{5}}{6}$
- 13) The equation of the circle with centre at (0, 0) and radius r is
a) $x^2 + y^2 = r^2$ b) $x + y = r$ c) $\sqrt{x} + \sqrt{y} = r$ d) none of these
- 14) A point is in the XZ plane. Then the value of y-coordinate is
a) 0 b) 1 c) -1 d) none of these
- 15) The distance between the pair of points (2, 3, 5) and (4, 3, 1) is
a) 2 units b) $\sqrt{3}$ units c) $2\sqrt{5}$ d) none of these
- 16) $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$ is equal to
a) 0 b) 1 c) $\frac{1}{2}$ d) 2

- 17) $\lim_{x \rightarrow 0} \frac{x^n - a^n}{x - a}$ is equal to
 a) na^n b) na^{n-1} c) na d) 1
- 18) A batsman scores runs in 10 innings as 38, 70, 48, 34, 42, 55, 63, 46, 54 and 44. The mean deviation about mean is
 a) 8.6 b) 6.4 c) 10.6 d) 7.6
- 19) One card is drawn from a pack of 52 cards. The probability that it is the card of a king or spade is
 a) $\frac{1}{26}$ b) $\frac{3}{26}$ c) $\frac{4}{13}$ d) $\frac{3}{13}$
- 20) Two dice are thrown together. The probability of obtaining a total score of 5 is
 a) $\frac{1}{18}$ b) $\frac{1}{12}$ c) $\frac{1}{9}$ d) none of these

Section – B (Each of 2 marks)

- 21) If the first term of an A.P is 2 and the sum of first five terms is equal to one – fourth of the sum of the next five terms, find the sum of first 30 terms.

OR

The sum of n terms of two arithmetic progressions are in the ratio $(3n + 8) : (7n + 15)$. Find the ratio of their 12th term.

- 22) The base of an equilateral triangle with side 2a lies along the y-axis such that the mid – point of the base is at origin. Find the vertices of the triangle.
- 23) Find the equation of the circle having centre at (3, -4) and touching the line $5x + 12y - 12 = 0$.
- 24) If the mean and standard deviation of 100 observations are 50 and 4 respectively. Find the sum of the observations and the sum of their squares.
- 25) Three dice are thrown together. Find the probability of getting a total of at least 6.

OR

Tickets numbered from 1 to 20 are mixed up together and then a ticket is drawn at random. What is the probability that the ticket has a number which is a multiple of 3 or 7 ?

Section – C (Each of 3 marks)

- 26) Let R be the relation on set N of natural numbers defined by
 $R = \{ (a, b) : a + 3b = 12, a \in N, b \in N \}$. Find
 i) R ii) Domain of R iii) Range of R
- 27) Find the domain for which the function $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal.
- 28) Prove that : $\cot^2 \frac{2\pi}{6} + \operatorname{cosec} \frac{5\pi}{6} + 3 \tan^2 \frac{\pi}{6} = 6$.

OR

If $\cos A = \frac{4}{5}$, $\cos B = \frac{12}{13}$, $\frac{3\pi}{2} < A, B < 2\pi$, find the values of the following :

- (i) $\cos(A + B)$ (ii) $\sin(A - B)$
- 29) Find the lengths of the medians of the triangle with vertices A(0,0,6) B (0,4,0) and C (6,0,0).
- 30) Evaluate the following limits : $\lim_{x \rightarrow a} \frac{\cos x - \cos a}{\cot x - \cot a}$.
- 31) Differentiate the following function with respect to x : $\frac{\sin(x+a)}{\cos x}$.

OR

If $y = \sqrt{\frac{x}{a}} + \sqrt{\frac{a}{x}}$, prove that $2xy \frac{dy}{dx} = \left(\frac{x}{a} - \frac{a}{x} \right)$.

Section - D (Each of 5 marks)

- 32) Prove that $(\cos \alpha + \cos \beta)^2 + (\sin \alpha + \sin \beta)^2 = 4 \cos^2\left(\frac{\alpha - \beta}{2}\right)$.
- 33) Exhibit graphically the solution set of the linear inequations :
 $3x + 4y \leq 12, 4x + 3y \leq 12, x \geq 0, y \geq 0$
- 34) If points (a, 0), (0, b) and (x, y) are collinear, using the concept of slope , prove that $\frac{x}{a} + \frac{y}{b} = 1$.
- 35) Find the mean deviation about the mean for the following data :

Marks Obtained	10 - 20	20-30	30-40	40-50	50-60	60-70	70-80
Number of students	2	3	8	14	8	3	2

OR

The mean and standard deviation of 20 observations are found to be 10 and 2 respectively. On rechecking, it was found that an observation 8 was incorrect. Calculate the correct mean and standard deviation If the wrong item is omitted.

Section – E (Each of 4 marks)

- 36) If F is a function satisfying $f(x + y) = f(x) f(y)$ for all $x, y \in \mathbb{N}$ such that $f(1) = 3$ and $\sum_{x=1}^n f(x) = 120$, find the value of n.
- 37) A beam is supported at its ends by supports which are 12 meters apart. Since the load is connected at its centre , there is a deflection of 3 cm at the centre and the deflected beam is in the shape of a parabola. How far from the centre is the deflection 1 cm ?
- 38) One card is drawn from a pack of 52 cards, each of the 52 cards being equally likely to be drawn . Find the probability that the card drawn is :
- i) an ace ii) red iii) either red or king iv) red and a king.