

J B Academy
Half Yearly Examination 2023-24
Class XI

Time : 3 hr

Sub- Mathematics

MM : 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 one mark)

- 1) If A and B are two sets then $A \cap (B \cup A)$ equals :
a) A b) B c) ϕ d) A'
- 2) Two finite sets have m and n elements. The total no of subsets of the first set is 48 more than the total no of subsets of the second set. The value of m and n are
a) 7,6 b) 6,3 c) 6,4 d) 7,4
- 3) Domain of $\sqrt{a^2 - x^2}$ ($a > 0$) is
a) $(-a, a)$ b) $[-a, a]$ c) $[0, a]$ d) $(-a, 0]$
- 4) If R is a relation on a finite set having n elements then the no of relations on A is
a) 2^n b) 2^{n^2} c) n^2 d) n^n
- 5) The radius of the circle whose arc of length 15π cm makes an angle $\frac{3\pi}{4}$ radian at the centre is
a) 10 cm b) 20 cm c) $11\frac{1}{4}$ cm d) $22\frac{1}{2}$ cm
- 6) If OP makes 4 revolution in one second , the angular velocity in radian per second is :
a) π b) 2π c) 4π d) 8π
- 7) If $\tan A = \frac{a}{a+1}$ and $\tan B = \frac{1}{2a+1}$, then the value of $A + B$ is :
a) 0 b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{4}$
- 8) The conjugate of a complex number is $\frac{1}{i-1}$ then the complex no is
a) $\frac{-1}{i-1}$ b) $\frac{1}{i+1}$ c) $\frac{-1}{i+1}$ d) $\frac{1}{i-1}$
- 9) If $z = \frac{1}{1 - \cos\theta - i \sin\theta}$, then $\text{Re}(z)$

- a) 0 b) $\frac{1}{2}$ c) $\frac{3}{4}$ d) 1
- 10) If $\sqrt{a+ib} = x + iy$ then possible value of $\sqrt{a-ib}$ is
a) $\sqrt{x^2+y^2}$ b) $x + iy$ c) $x - iy$ d) $\sqrt{x^2-y^2}$
- 11) Solve for x if $\frac{1}{x+2} > 0$
a) $x \in (-2, \infty)$ b) $x \in (2, \infty)$ c) $x \in (-\infty, 2)$ d) Does not exist
- 12) Find all pairs of consecutive odd positive integers both of which are smaller than 10 such that their sum is more than 11
a) (5,7) and (7,9) b) (7,9) and (9,11) c) (5,7) and (5,13) d) none of these
- 13) How many three digit numbers can be formed by using the digits 1 to 9 If no digit is repeated
a) 500 b) 501 c) 502 d) 504
- 14) In how many ways can a team of three boys and three girls be selected from five boys and four girls?
a) 39 b) 40 c) 41 d) 42
- 15) Fifth term in the expansion of $(3x - 2y)^7$ will be
a) $15120x^3y^4$ b) $15210 x^3y^4$ c) $15120 x^4y^3$ d) none of these
- 16) The value of $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$ will be
a) $40\sqrt{6}$ b) $-40\sqrt{6}$ c) $120\sqrt{6}$ d) none of these
- 17) Which term of the sequence 2, $2\sqrt{2}$, 4 is128?
a) 12 b) 13 c) 14 d) 15
- 18) How many terms of G.P. 3, 9, 27, are needed to give the sum 120?
a) 3 terms b) 4 terms c) 5 terms d) 6 terms
- 19) Find the value of r of a G.P. for which sum of the first two terms is -4 and the fifth term is 4 times the third term
a) $r = \pm 3$ b) $r = \pm 4$ c) $r = \pm 2$ d) none of these
- 20) Find the 12th term of a G.P. whose 8th term is 192 and the common ratio is 2
a) 3070 b) 3071 c) 3072 d) none of these

Section – B (each of 2 marks)

- 21) Differentiate between equal and equivalent set with suitable example.
- 22) Let $A = \{ 1, 2 \}$ and $B = \{ 3, 4 \}$. Find the number of relations from A to B.

23) Find the radius of the circle in which the central angle of 60° intercepts arc of length 37.4 cm. (use $\pi = \frac{22}{7}$)

24) For what value of x the numbers $-\frac{2}{7}$, x, $-\frac{7}{2}$ are in G.P. ?

25) Find the multiplicative inverse of $2 - 3i$.

Section – C (each of 3 marks)

26) Find the domain and range of the following function

$$f(x) = \sqrt{9 - x^2}$$

27) Prove that $\frac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$.

28) Express the complex no in the form of a + ib
 $i^9 + i^{19}$

29) Given 5 flags of different colours, how many different signals can be generated if each signal requires the use of 2 flags, one below the other ?

30) Using binomial theorem evaluate : $(96)^3$

31) Find 4 numbers forming a geometric progression in which the 3rd term is greater than the first term by 9 and the second term is greater than 4th term by 18.

Section – D (each of 5 marks)

32) If $\tan x = \frac{3}{4}$, $\pi < x < \frac{3\pi}{2}$ find the values of $\sin \frac{x}{2}$, $\cos \frac{x}{2}$ and $\tan \frac{x}{2}$.

33) A man wants to cut three lengths from a single piece of board of length 91 cm. The second length is to be 3 cm 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 atleast 5 cm longer than the second.

34) A group consists of 4 girls and 7 boys . In how many ways can a team of 5 members be selected if the team has

(i) No girl ?

(ii) at least 1 boy and 1 girl ?

(iii) at least 3 girls ?

35) The sum of two numbers is 6 times their geometric mean, show that the numbers are in the ratio $(3 + 2\sqrt{2}) : (3 - 2\sqrt{2})$.

Section – E (each of 4 marks)

- 36) In a survey of 100 persons it was found that 28 read magazine A, 30 read magazine B, 42 read magazine C, 8 read magazines A and B, 10 read magazines A and C, 5 read magazines B and C and 3 read all the 3 magazines find
- (i) How many read none of three magazines ?
 - (ii) How many read magazines C only ?

OR

- In a survey of 100 students the no of students studying the various languages were found to be: English only 18, English but not hindi 23, English and Sanskrit 8, English 26, Sanskrit 48, Sanskrit and hindi 8, No language 24. Find : (i) How many students were studying hindi ?
(ii) How many students were studying English and hindi ?

- 37) In an experiment, a solution of hydrochloric acid is to be kept between 30° and 35° celsius. What is the range of temperature in degree Fahrenheit if conversion formula is given by $C = \frac{5}{9} (F - 32)$, where C and F represent temperature in degree Celsius and degree Fahrenheit respectively.

OR

Solve the system of inequalities graphically

$$X + 2y \leq 8; \quad 2x + y \leq 8; \quad x \geq 0, \quad y \geq 0$$

- 38) How many words with or without meaning can be made from the letters of the word MONDAY, assuming that no letter is repeated if
- (i) Four letters are used at a time
 - (ii) All letters are used and first letter is a vowel ?