

Roll No. _____

Code : 112021 M-A

Please check that this question paper contains 38 questions and 8 printed pages.

CLASS-XI
MATHEMATICS (THEORY)
ANNUAL EXAM (2020-21)

Time allowed : 3 hours

Maximum Marks : 80

General Instructions :

1. *This question paper contains two parts A and B. Each part is compulsory. Part A carries 24 marks and Part B carries 56 marks.*
2. *Part A has Objective Type Questions and Part B has Descriptive Type Questions.*
3. *Both Part A and Part B have choices.*

Part-A

1. *It consists of two sections I and II.*
2. *Section I comprises of 16 very short answer type questions, with choices in 5 questions.*
3. *Section II contains 2 case studies. Each case study comprises of 5 case based MCQs. An examinee is to attempt any 4 out of 5 MCQs.*

Part-B

1. *It consists of three sections III, IV and V.*
2. *Section III comprises of 10 questions of 2 marks each.*
3. *Section IV comprises of 7 questions of 3 marks each.*
4. *Section V comprises of 3 questions of 5 marks each.*
5. *Internal choice is provided in 3 questions of Section III, 2 questions of Section IV and 3 questions of Section V. You have to attempt only one of the alternatives in all such questions.*

Part-A

Section-I

All questions are compulsory. In case of internal choices attempt any one.

1. How many elements has the Power set of A, if A is an empty set ? 1

2. If $P = \{x : x < 3, x \in \mathbb{N}\}$, $Q = \{x : x \leq 2, x \in \mathbb{W}\}$. Find $(P \cup Q) \times (P \cap Q)$, where \mathbb{W} is the set of whole number and \mathbb{N} is the set of natural number. 1
3. A wheel makes 360 revolutions in one minute. Through how many radians does it turn in one second ? 1
4. Find the value of $\sin\left(-\frac{11\pi}{3}\right)$. 1

OR

If $\cot x = -\frac{5}{12}$, x lies in second quadrant, find the value of $\sin x$.

5. Find the real value of 'a' for which $3i^3 - 2ai^2 + (1 - a)i + 5$ is a real number. 1
6. Find the multiplicative inverse of $-i$ in the form of $a + ib$. 1

OR

Find the value of $1 + i^2 + i^4 + i^6 + \dots + i^{20}$.

7. Solve : $-12x > 30$ when x is a natural number. 1
8. Find the total number of ways in which six '+' and four '-' signs can be arranged in a line such that no two '-' signs occur together. 1
9. How many 5 digit telephone numbers can be constructed using the digit 0 to 9, if each number starts with 67 and no digit appears more than once ? 1

OR

Out of 18 points in a plane, no three are in the same line except five points which are collinear. Find the number of lines that can be formed joining the point.

10. The Fibonacci sequence is defined by $1 = a_1 = a_2$ and $a_m = a_{m-1} + a_{m-2}$, $n > 2$.

Find $\frac{a_{n+1}}{a_n}$, for $n = 1$. 1

OR

A man starts repaying a loan as first instalment of ₹ 100. If he increases the instalment by ₹ 5 every month, what amount he will pay in the 30th instalment ?

11. If a, b, c are in A.P., then find a point through which straight line $ax + by + c = 0$ will pass through. 1

OR

Find the slope of the line, which makes an angle of 30° with the positive direction of y -axis measured anticlockwise.

12. Find the centre and radius of circle $2x^2 + 2y^2 - x = 0$. 1
13. Name the octants in which the following points lie : 1
- (i) $(4, -2, 3)$ (ii) $(-2, -4, -7)$
14. Evaluate : $\lim_{x \rightarrow 0} \frac{\sin ax}{bx}$ 1
15. Find the derivative of $199x$ with respect to x at $x = 100$. 1

OR

Find derivative of $\sin x^\circ$ with respect to x .

16. The mean and standard deviation of 6 observations are 8 and 4 respectively. If each observations is multiplied by 3 then find new variance. 1

Section-II

Both the case study based questions are compulsory. Attempt any 4 sub-parts from each question (17-21) and (22-26). Each question carries 1 mark.

17. Above is a iron suspension bridge across one of the river. The Cable of uniformly loaded suspension bridge hangs in the form of parabola. The roadway which is supposed to be horizontal and 200 meter long is supported by vertical wires attached to the cable, the longest wire being 22 meter and shortest being 2 meter.



1×4=4

- (i) What is equation of parabola symmetric about y -axis and focus at $(0, a)$?
- (a) $Y^2 = 4ax$ (b) $x^2 = 4ay$
- (c) $Y^2 = x$ (d) $x^2 = y$

Let E : "A Passenger travelling in first class was survived".
 F : "A Passenger travelling in second class was survived".
 G : "A Passenger travelling in Titanic was survived".
 H : "A Passenger travelling in third class was survived".
 be four events.

- (i) Event E and F are :
- (a) Mutually exclusive events
 - (b) Exhaustive events
 - (c) Mutually exclusive and exhaustive events
 - (d) None of these
- (ii) Events E, F and H are :
- (a) Mutually exclusive events
 - (b) Exhaustive events
 - (c) Mutually exclusive and exhaustive events
 - (d) None of these
- (iii) Event E or F is equal to :
- (a) Not E and F
 - (b) Not G and H
 - (c) Not H
 - (d) None of these
- (iv) Probability of E or F :
- (a) Zero
 - (b) $\frac{499}{1316}$
 - (c) $\frac{317}{1316}$
 - (d) None of these
- (v) Probability of a passenger on board did not survive :
- (a) $\frac{499}{1316}$
 - (b) $\frac{817}{1316}$
 - (c) Zero
 - (d) $\frac{317}{499}$

Part-B

Section-III

19. For two non-empty sets A and B, if $P(A) = P(B)$. Show that $A = B$.

2

OR

Show that if $A \subset B$, then $C - B \subset C - A$.

20. Draw appropriate Venn diagram : 2

(i) $(A \cup B)'$ (ii) $A' \cup B'$

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

22. A circular wire of radius 3 cm is cut and bent so as to lie along the circumference of a hoop whose radius is 48 cm. Find the angle in degrees which is subtended at the centre of hoop. 2

23. Solve the equation : $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$ 2

OR

If $(a + ib)(c + id)(e + if)(g + ih) = A + iB$, then show that

$$(a^2 + b^2)(c^2 + d^2)(e^2 + f^2)(g^2 + h^2) = A^2 + B^2.$$

24. The longest side of a triangle is twice the shortest side and the third side is 2 cm longer than the shortest side. If the perimeter of the triangle is more than 166 cm then find the minimum length of the shortest side. 2

25. Determine the number of 5 card combination out of a deck of 52 cards if there is exactly one ace in each combination. 2

26. If $a\left(\frac{1}{b} + \frac{1}{c}\right)$, $b\left(\frac{1}{c} + \frac{1}{a}\right)$, $c\left(\frac{1}{a} + \frac{1}{b}\right)$ are in A.P., prove that a , b , c are in A.P. 2

27. If the p^{th} , q^{th} and r^{th} terms of a G.P. are a , b and c , respectively, prove that

$$a^{q-r} b^{r-p} c^{p-q} = 1. \quad 2$$

28. Find $\lim_{x \rightarrow 0} f(x)$, where $f(x) = \begin{cases} \frac{x}{|x|}, & x \neq 0 \\ 0, & x = 0. \end{cases}$ 2

OR

Suppose $f(x) = \begin{cases} a + bx & , x < 1 \\ 4 & , x = 1 \\ b - ax & , x > 1 \end{cases}$

and if $\lim_{x \rightarrow 1} f(x) = f(1)$ what are possible values of a and b ?

Section-IV

All questions are compulsory. In case of internal choices attempt any one.

29. In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. How many like tennis only and not cricket ? How many like tennis ? 3
30. If $m \sin \theta = n \sin (\theta + 2\alpha)$, then prove that $(\theta + \alpha) \cot \alpha = \frac{m + n}{m - n}$. 3

OR

Prove that $\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x = 1$.

31. Reduce $\left(\frac{1}{1 - 4i} - \frac{2}{1 + i} \right) \left(\frac{3 - 4i}{5 + i} \right)$ to the standard form. 3
32. Solve the following system of inequalities graphically : 3
 $x + y \leq 9, \quad y > x, \quad x \geq 0$

OR

A solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid. If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added ?

33. From a class of 25 students, 10 are to be chosen for an excursion party. There are 3 students who decide that either all of them will join or none of them will join. In how many ways can the excursion party be chosen ? 3
34. Find the coordinates of the foot of perpendicular from the point $(-1, 3)$ to the line $3x - 4y - 16 = 0$. 3
35. Find derivative of $\cos\left(x - \frac{\pi}{8}\right)$ by first principle. 3

Section-V

All questions are compulsory. In case of internal choices attempt any one.

36. Find $\sin \frac{x}{2}$, $\cos \frac{x}{2}$ and $\tan \frac{x}{2}$ if $\tan x = -\frac{4}{3}$, $\frac{\pi}{2} < x < \pi$. 5

OR

If $\sin (\theta + \alpha) = a$ and $\sin (\theta + \beta) = b$, then prove that
 $\cos 2 (\alpha - \beta) - 4ab \cos (\alpha - \beta) = 1 - 2a^2 - 2b^2$.

37. If a, b, c are in A.P.; b, c, d are in G.P. and $\frac{1}{c}, \frac{1}{d}, \frac{1}{e}$ are in A.P. prove that a, c, e are in G.P.

OR

If a and b are the roots of $x^2 - 3x + p = 0$ and c, d are roots of $x^2 - 12x + q = 0$, where a, b, c, d form a G.P., prove that $(q + p) : (q - p) = 17 : 15$. 5

38. 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 in each of the following cases : 5

- (i) If wrong item is omitted (ii) If it is replaced by 12.

OR

Calculate the mean deviation about median age for the age distribution of 100 persons given below :

Age	Number
16-20	5
21-25	6
26-30	12
31-35	14
36-40	26
41-45	12
46-50	16
51-55	9

□□□