

HALF YEARLY EXAMINATION 2024-25

Mathematics

Time Allowed: 3 Hours

Class-11

Maximum marks: 80

General Instructions:

1. This question paper contains- five sections A, B, C, D and E. Each section is compulsory.
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.

Sr. No.		Marks
<u>SECTION-A</u>		
1.	If $n(A) = 54, n(B) = 69$ and $n(A \cup B) = 83$ , then $n(B \cap \bar{A}) =$ a) 29      b) 0      c) 69      d) 14	1
2.	If $A = \{(x, y) : y = e^x, x \in R\}$ and $B = \{(x, y) : y = x, x \in R\}$ then a) $A \cap B = \{(0, 1)\}$ b) $A \cap B = \emptyset$ c) $A \subset B$ d) $A \cup B = A$	1
3.	If $A - B = \frac{\pi}{4}$ then $(1 + \tan A)(1 - \tan B) =$ a) 1      b) 3      c) 0      d) 2	1
4.	Let $f$ and $g$ be two functions given by $f = \{(2, 4), (5, 6), (8, -1), (10, -3)\}$ and $g = \{(2, 5), (7, 1), (8, 4), (10, 13), (11, -5)\}$ then domain of $(f - g)$ is a) $\{5\}$ b) $\{2, 7, 8, 10, 11\}$ c) $\{2, 4, 5, 8, 10\}$ d) $\{2, 8, 10\}$	1
5.	Range of $f(x) = \frac{1}{1-2\cos x}$ is a) $[\frac{1}{3}, 1]$ b) $[-1, \frac{1}{3}]$ c) $(-\infty, -1] \cup [\frac{1}{3}, \infty)$ d) $[-\frac{1}{3}, 1]$	1
6.	What is the conjugate of $(-2 - i^3)$ a) $-2 - i$ b) $2 + i$ c) $-2 + i$ d) $2 - i$	1
	Let $f: R \rightarrow R$ be defined by $f(x) = x^2 + 1$ then $\{x : f(x) = -15\}$ is a) $\{4\}$ b) $\{-4, 4\}$ c) $\emptyset$ d) $\{\emptyset\}$	1
	For $f(x) = \begin{cases} -3; & x \neq 2 \\ k; & x = 2 \end{cases}$ ; and $\lim_{x \rightarrow 2} f(x) = f(2)$ , then $k =$ a) 2      b) 0      c) -3      d) All real values.	1
	Which of the following expression represents to calculate variance of a discrete	1

	frequency distribution table? a) $\frac{\sum f_i(x_i - \bar{x})}{N}$ b) $\frac{\sum f_i(x_i - \bar{x})^2}{N}$ c) $\frac{\sqrt{\sum f_i(x_i - \bar{x})^2}}{N}$ d) none	
10.	$\lim_{x \rightarrow \pi/2} \frac{\tan 2x}{(\frac{\pi}{2} - x)} =$ a) 2      b) -1/2      c) 0      d) -2	1
11.	The value of $\frac{\cos 3x}{2\cos 2x - 1} =$ a) $\cos x$ b) $\sin x$ c) $\tan x$ d) none of these.	1
12.	$\frac{\tan 80^\circ - \tan 10^\circ}{\tan 70^\circ} =$ a) 0      b) 1      c) 2      d) 3	1
13.	$(\sqrt{-2})(\sqrt{-5}) =$ a) $\sqrt{10}$ b) $-\sqrt{10}$ c) $i\sqrt{10}$ d) none of these	1
14.	If $\frac{1}{x-2} \leq 1$ , then $x \in$ a) $[3, \infty)$ b) $(-\infty, 2)$ c) $(-\infty, 2) \cup [3, \infty)$ d) $(-\infty, 2) \cup (3, \infty)$	1
15.	If $\frac{ x-2 }{x-2} \geq 0$ , then $x \in$ a) $[2, \infty)$ b) $(2, \infty)$ c) $(-\infty, 2)$ d) $(-\infty, 2]$	1
16.	If $f(x) =  x $ then $f'(-\frac{5}{2}) =$ a) $\frac{-5}{2}$ b) 1      c) 0      d) -1	1
17.	For the curve $\sqrt{x} + \sqrt{y} = 4$ , $\frac{dy}{dx}$ at $(\frac{1}{4}, \frac{1}{4}) =$ a) -1      b) 1      c) 2      d) $\frac{1}{2}$	1
18.	The derivative of $\log x$ with respect to $\frac{1}{x}$ a) $\frac{-1}{x^3}$ b) $\frac{-1}{x}$ c) $-x$ d) $\frac{1}{x}$	

**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 correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

19. Assertion (A):  $\lim_{x \rightarrow 0} \frac{\tan 2x}{x} = 2$  1  
Reason (R):  $\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 0$
20. Assertion (A): If  $\tan x = \frac{a}{a-1}$  &  $\tan y = \frac{1}{2a-1}$ , then  $x - y = \frac{\pi}{4}$  1  
Reason (R):  $\tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$

SECTION-B

21. Let  $R = \{(x, y) : x + 2y = 10 ; x, y \in A\}$  be a relation defined on a set A of first ten natural numbers. Determine its Domain and Range. 2
22. Find the value of  $\sin \frac{x}{2}$  &  $\cos \frac{x}{2}$  if  $\sin x = \frac{\sqrt{5}}{3}$  and x lies in 2<sup>nd</sup> quadrant. 2
23. Represent the solution of the inequality  $\frac{2x+1}{7x-1} > 5$  on real number line. 2
24. Evaluate:  $\lim_{x \rightarrow 0} \frac{\cos 3x - \cos x}{x^2}$  2
25. Find the complex number which when multiplies by  $5 + 3i$  gives  $3 - 4i$ . 2

SECTION-C

26. Find the Domain and Range of the function  $f(x) = \frac{x^2 - x}{2x + x^2}$  3
27. Prove that :  $\sin 20^\circ \cdot \sin 40^\circ \cdot \sin 60^\circ \cdot \sin 80^\circ = \frac{3}{16}$  3
28. Solve the system of inequations graphically.  
 $2x + y \geq 2 ; x - y \leq 1 ; x + 2y \leq 8 ; x, y \geq 0$  3
29. Find the modulus and the multiplicative inverse of the complex number  $Z = \frac{1+2i}{1+(1-i)^2}$  3
30. Let  $L = [-6, 4]$ ,  $M = [-3, -1)$  and N be the set of natural numbers, then find  
a)  $L - M$       b)  $L \cap M \cap N$       c)  $(M - L) \cup L'$  3
31. Find  $\frac{dy}{dx}$  at  $x = 1, y = \frac{\pi}{4}$ , if  $\sin^2 y + \cos xy = k$ . 3

SECTION-D

32. Evaluate: a)  $\lim_{x \rightarrow 2} \left( \frac{2^{x+2} - 16}{4^x - 16} \right)$       b)  $\lim_{x \rightarrow \frac{\pi}{6}} \frac{\sqrt{3} \sin x + \cos x}{x + \frac{\pi}{6}}$  5
33. Find  $\frac{dy}{dx}$  (a) if  $y = (\log x)^{\cos x} - \frac{x^2 - 1}{x + 1}$  5  
(b) if  $x = a(\cos t + t \sin t) ; y = a(\sin t - t \cos t)$ .
34. Calculate the Mean and Variance for the following distribution. 5

Marks	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of students	3	6	13	15	14	5	4

35. Prove that (a)  $\frac{\cos 7x - \cos 8x}{1 + 2\cos 5x} = \cos 2x - \cos 3x$   
 (b) If  $m \sin A = n \sin (A + 2\alpha)$ , Prove that  $\tan(A + \alpha) = \frac{m+n}{m-n} \tan \alpha$ .

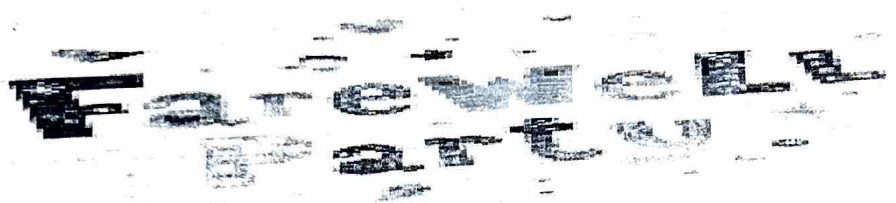
5

SECTION-E

This section comprises of 3 case-study/passage-based questions of 4 marks each with two sub-parts. First case study question has three sub-parts. The 2<sup>nd</sup> and third case study questions have two sub-parts of 2 marks each.

36. Case-study 1:

1+1+2



The school organised a farewell party of 100 students and school management decided three types of drinks as Milk(M), coffee(C) and Tea(T) to distribute in party. It was reported later, 10 students had all the three drinks, 20 had M and C, 30 had C and T, 25 had M and T. 12 had M only, 5 had C only and 8 had T only.

- (i) Find the number of students who did not take any drink
- (ii) Find the number of students who preferred Milk and coffee but not tea.
- (iii) Number of students who preferred exactly two of the three drinks.

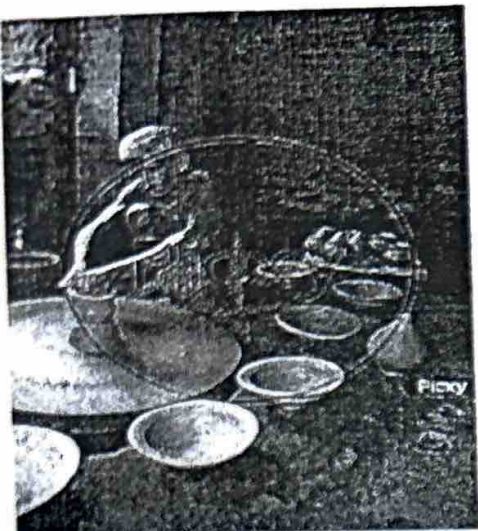
37. Case-study 2:

2+2

A function  $f(x)$  is said to have existence of its limit  $\lim_{x \rightarrow a} f(x)$  if its both left as well as right limit at  $x = a$  equal i.e  $\lim_{x \rightarrow a^+} f(x) = \lim_{x \rightarrow a^-} f(x)$ .

- a) For what value of  $k$ ,  $\lim_{x \rightarrow 0} f(x)$  exists if the function  $f(x) = \begin{cases} k(x^2 - 2x); & x \leq 0 \\ 4x + 1; & x > 0 \end{cases}$ .
- b) Find the value of  $n$ , if  $\lim_{x \rightarrow 2} \frac{x^n - 2^n}{x - 2} = 80; x \in N$ .

Case-study 3:



A potter made a mud vessel, where the shape of the pot is based on a function

$f(x) = |x - 3| + |x - 2|$ ; where  $f(x)$  represents the height of the pot in feet.

- What will be the height if  $2 < x < 3$ . Also find the minimum height of the pot for all  $x \in R$ .
- Redefine the given function  $f(x)$  for  $x \in [0, 5]$ .

2+2

