B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

PRE MID TERM EXAMINATION 2025-26
MATHEMATICS (Marking Scheme)

Class: XII A **Time: 1hr**
Date: 06/08/25 **Max Marks: 25**
Admission no: **Roll no:**

General Instructions:
Question 1 to 5 carries ONE mark each. Questions 6 to 9 carries TWO marks each.
Questions 10 to 13 carries THREE marks each.

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1. The function f(x) = $\frac{4-x^2}{4x-x^3}$

(A) Discontinuous at only one point

(B) Discontinuous exactly at two points.

(C) Discontinuous at exactly three points.

(D) None of these

2 If x= a$\cos\theta$, y= a$\sin\theta$, then $\frac{dy}{dx}$ at $\theta=\frac{\pi}{4}$.

(A) 1 (B) 0 **(C) -1** (D) None of these

3 If y= $1+e^{3x}$, find $\frac{d^2y}{dx^2}$

(A) 0 (B) $6e^{3x}$ **(C) $9e^{3x}$** (D) None of these

4 If $x=t^2$ and $y= t^3$ then $\frac{d^2y}{dx^2}$

(A) 3/2 (B) 3/4t (C) 3/2t (D) 3/4

Assertion and Reasoning questions: In the following two 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 and R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

5 Assertion (A): The function f(x)= $e^{-|x|}$ continuous for all x.
Reason (R): f(x)= $e^{-|x|}$ is differentiable for all x.

6 Determine the value of 'k' for which the following function is continuous at x=3 , f(x)= $\begin{cases} \frac{(x)^2-9}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases}$.

Sol: Given function is continuous at x= 3, $\lim_{x\to 3} f(x)$ = f(3)

$\lim_{x\to 3} \frac{x^2-9}{x-3} = \lim_{x\to 3} \frac{(x+3)(x-3)}{x-3} = \lim_{x\to 3} x+3 = 6$ = f(3) = k =6

7 If xy =1, Prove that $\frac{dy}{dx}$ +y^2 = 0

Sol: Apply product rule **1**

dy/dx +y^2=0

8 Differentiate $(\sin x)^{\cos x}$ with respect to x.

Sol: $y=(\sin x)^{\cos x}$ apply log to both side logy = cosx logsinx

Diff. wrt x: 1/y $\frac{dy}{dx}$ = -sinx logsinx +cosx (1/sinx) cosx

= y(-sinx logsinx +cosx cotx)

= $(\sin x)^{\cos x}$(-sinx logsinx +cosx cotx)

9 The volume of a cube is increasing at a constant rate. Prove that the increase in Surface area varies inversely as the length of the edge of the cube.

Sol: $S=6x^2$ and $V= x^3$ and it is given that $\frac{dv}{dx}$ = k

dx/dt = $k/3x^2$

S= $6x^2$, ds/dt = 12xdx/dt , ds/dt = 12x . $k/3x^2$ = 4k/x

ds/dt $\propto$ 1/x

10 If the function f(x), given by f(x) = $\begin{cases} 3ax+b, if\ x>1 \\ 11, if\ x=1 \\ 5ax-2b, if\ x<1 \end{cases}$ is continuous at x=1.

Sol: (LHL at x=1) = 5a-2b

(RHL at x=1) = 3a+b and f(1) = 11, since f(x) is continuous at x=1

LHL at x=1 = RHL at x= 1= f(1)

5a-2b =3a+b =11

5a-2b =11 and 3a+b=11, a=3 and b=2.

11 If x^2+2xy+y^2 =42, find$\frac{dy}{dx}$.

Sol: 2x+2(xdy/dx+y) +$3y^2$dy/dx =0

2x+2y = -(2x+$3y^2$) dy/dx

dy/dx = $\frac{2x+2y}{2x+3y^2}$

12 If y= $\sin^{-1}x$, show that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$.

Sol: y= $\sin^{-1}x$, differentiate wrt x , dy/dx = $\frac{1}{\sqrt{1-x^2}}$, $\sqrt{1-x^2}$dy/dx = 1

Differentiate again wrt x $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$

13 Find the intervals in the function $f(x) = 2x^3+9x^2+12x+20$, (i) increasing, (ii) decreasing.

Sol: f'(x) = $6x^2 +18x +12 = 0$

x=-1 and -2

Now, check the behaviour of derivative on interval

$(-\infty, -2). (-2, -1)$ *and* $(-1, \infty)$

We found f is increasing on $(-\infty, -2) U (-1, \infty)$

and f is decreasing on (-2,-1)

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