

CHAPTER

5

Syllabus

Explanation: Given that,

$$f(x) = \cot x$$

It is discontinuous at

$$\sin x = 0$$

$\Rightarrow$

$$x = n\pi,$$

Thus, the given function is

$$\{x = n\pi : n \in \mathbb{Z}\}$$

Q. 4. If $f(x) = \begin{cases} mx + 1 & \text{if } x \leq \frac{\pi}{2} \\ \sin x + n, & \text{if } x > \frac{\pi}{2} \end{cases}$, is

then

(A) $m = 1, n = 0$ (B)

(C) $n = \frac{m\pi}{2}$ (D)

The functions e^x and $|x|$ are differentiable functions for all real value of x . Since e^x is differentiable everywhere, $|x|$ is non-differentiable at $x = 0$.

Thus, the given functions $f(x)$ are differentiable everywhere but not differentiable at $x = 0$.

- Q. 9.** Let $f(x) = |\sin x|$, then
- (A) f is everywhere differentiable
 - (B) f is everywhere continuous but not differentiable at $x = n\pi, n \in \mathbb{Z}$
 - (C) f is everywhere continuous but not differentiable at $x = (2n + 1)\frac{\pi}{2}, n \in \mathbb{Z}$
 - (D) none of these

Ans. Option (B) is correct.

Explanation: Given that,

$$f(x) = |\sin x|$$

The functions $|x|$ and $\sin x$ are differentiable functions for all real value of x .

Explanation: Given that,

$$x = t^2 \text{ and } y = t^3$$

$$\text{Then, } \frac{dx}{dt} = 2t \text{ and } \frac{dy}{dt} = 3t^2$$



ASSERTION

Directions: In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as

(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 the correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

Explanation: Since $\sin x$ and $\cos x$ are continuous functions in R , $|\sin x|$ is continuous in R .
Hence Λ is true.

$$|\sin x| = \begin{cases} -\sin x, & \text{if } x < 0 \\ \sin x, & \text{if } x \geq 0 \end{cases}$$

$$f(0) = |\sin 0| = 0$$

$$\begin{aligned} \text{LHD} = f'(0^-) &= \lim_{x \rightarrow 0^-} \frac{-\sin x}{x} \\ &= -1 \end{aligned}$$

$$\begin{aligned} \text{RHD} = f'(0^+) &= \lim_{x \rightarrow 0^+} \frac{\sin x}{x} \\ &= 1 \end{aligned}$$

At $x = 0$, $\text{LHD} \neq \text{RHD}$.

So $f(x)$ is not differentiable at $x = 0$.

Hence R is false.

Q. 6. Assertion (A): $f(x) = [x]$ is not continuous in R .

Reason (R): $f(x) = [x]$ is not continuous in R .

Answer: Option (A) is incorrect.

Q. 3. $\frac{d}{dx}(\sin^3 x) = \underline{\hspace{2cm}}.$

(A) $\cos^3 x$

(C) $3\sin^2 x \cos x$

Ans. Option (C) is correct.

Explanation:

$$\begin{aligned}\frac{d}{dx}(\sin^3 x) &= 3\sin^2 x \frac{d}{dx}(\sin x) \\ &= 3\sin^2 x \cos x\end{aligned}$$

Q. 4. $\frac{d}{dx} \sin x^3 = \underline{\hspace{2cm}}.$

(A) $\cos(x^3)$

(C) $3x^2 \sin(x^3)$

Ans. Option (D) is correct.

Explanation:

$$\frac{d}{dx}(\sin x^3) = \cos x^3 \frac{d}{dx}(x^3)$$