Name : Fardouse Lomat Jahan Rumpa

Dept : B.Sc in CSE

ID No : 2219170041

Batch : 17 th

Course Title : Differential Equation and Fouriere Analysis

Course Code : MAT 325

Semester : Summer - 2023

Ans to the Qus No: 01

(1) Answer:

$$\lim_{x \to 0} \frac{\sqrt{1+x} - 1}{x}$$

By Using Rationalezation,

$$\Rightarrow \lim_{x \to 0} \sqrt{\frac{1+x-1}{x}} \times \frac{\sqrt{1+x}+1}{\sqrt{1+x}+1}$$

$$\Rightarrow \lim_{x - 0} \frac{\sqrt{(1-x)} - 1}{x(\sqrt{1+x}+1)}$$

$$\Rightarrow \lim_{x \to 0} \frac{x}{x(\sqrt{1+x}+1)}$$

$$= \frac{1}{\sqrt{1}+1}$$

$$= \frac{1}{2}$$

(Ans)

Ans to the Qus No: 02

② **Answer:**

Derivative of $f(x) = x^3 + 5x^2$

Here's the step by step ~~mat~~ to finding the derivative of ~~d~~ $f(x) = x^3 + 5x^2$:

Given function: $f(x) = x^3 + 5x^2$

Step-1: Differentiate the first term x^3 using the power rule,

$$\frac{d}{dx}(x^3) = 3x^{3-1} = 3x^2$$

Step-2: Differentiate the second term $5x^2$ using the power rule,

$$\frac{d}{dx}(5x^2) = 2 \cdot 5x^{2-1}$$

$$= 10x$$

Step-3: Combine the derivatives of the individual terms.

$$f'(x) = 3x^2 + 10x$$

So, the derivative of $f(x) = x^3 + 5x^2$ with respect to x is $f'(x) = 3x^2 + 10x$

(Ans)

Ans to the Qus NO: 03

③ Answer: $\int (2e^x + \frac{6}{x} + \ln 2)\, dx$

$\Rightarrow 2e^x + 6\ln x + x\ln 2 + c$

$= 2e^x + 6\ln x + x\ln 2 + c$

Ans:

Ans to the Qus NO: 04

④ Answer: if $f(x) = x^2 \sin x$. Find $f'(x)$.

To find $F'(x)$, the derivative of $f(x) = x^2 \sin(x)$ we can use the product rule.

The product rule states that if you have two functions $u(x)$ and $v(x)$, then the derivative of their product $u(x) \cdot v(x)$ with respect to x is given by:

$(u \cdot v)' = u' \cdot v + u \cdot v'$

in this case, we have $u(x) = x^2$ and $v(x) = \sin(x)$.

Lets find the derivatives;

$$u'(x) = \frac{d}{dx}(x^2) = 2x$$

$$u'(x) = \frac{d}{dx}(\sin(x)) = \cos(x)$$

Now apply the product rule:

$$f'(x) = (u \cdot v)' = u' \cdot v + u \cdot v'$$

$$= (2x) \cdot (\sin(x)) + (x^2)(\cos(x))$$

So, the derivatives of $f(x) = x^2 \sin(x)$ with respect to x is,

$$f'(x) = 2x \sin(x) + x^2 \cos(x)$$

Ans to the Qus No: Q(5)

Ans: Chain theorem:

The "Chain Rule" is a fundamental rule in calculus that describes how to find the derivative of composite function. In mathmatical terms, It states that if you have a function that is a composition of two functions, say $f(g(x))$, then the derivative of this composition function can be found by multiplying the derivative of the outer function f with the derivative of the inner function g.

Mathmatically, the chain Rule can be stated as follows;

if $y = f(g(x))$, then the derivative $\frac{dy}{dx}$ is given by;

$$\frac{dy}{dx} = \frac{dy}{dx} \cdot \frac{dg}{dx}$$

In words, you differentiate the outer function with respect to the inner function, and them multiply it by the derivative of the inner function with respect to x.

The chain Rule is a powerful tool for finding derivatives of complex functions. that can be expressed as a composition of simplere functions. It is an essential concept in calculu and is widely used in various fields of mathmatic and science including physics, engineering and economics.