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Course – Differential Equation And Anylysis.

Code – MAT 325

Answer to the Question NO–1

(1) Ans:

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

By using Rationalization

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

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

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

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

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

Answer to the Question No-2

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

Here is the step by step to finding the derivative of $f(x) = x^3 + 5x^2$

step-1: Differentiate the first term x^3 using the power rule.

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

step-2 Defferentite the 2end terms $5x^2$ using the power rule, $\frac{d}{dx}(5x^2) = 2 \cdot 5x^{2-1}$

$= 10x$.

step 3: Combine the derivatives of the individual term

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

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

Answer to Question No -3

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

$= 2^{ex} + 6\ln x + x\ln 2 + C$

$= 2^{ex} + 6\ln x + x\ln 2 + C$ Ans

Answer to the question -4

(4) Ans: $f(x) = x^2 \frac{d}{dx}(\sin x) + \sin x \frac{d}{dx}(x)^2$

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

$= x^2 \cos x + 2x \sin x$

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

Answer to question-no-5

Ans: Chain theorem: The chain rule states that to compute the derivative of $f \circ g \circ h$, it is sufficient to compute the derivative of f. And the derivative of $g \cdot h$.

The derivative of can be calculated directly And the derivative of $g \cdot h$ can be calculated by applying the chain rule Again.

$$\frac{du}{dx} = \frac{1}{g'(s,a)} \frac{du}{ds}$$

$$\frac{d^2u}{dx^2} = \frac{1}{[g'(s,a)]^2} \frac{d^2u}{ds^2} - \frac{g''(s,a)}{[g'(s,a)^3]} \frac{du}{ds}.$$