Date:

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Department : Bs (civil Engineering)

Section : (A)

Semester : 2nd

Subject : Applied Calculas

Date : 21/Aug/2021

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Q1)

The function $g(t)$ is defined by

$$g(t) = \begin{cases} 0 & t < 0 \\ t^2 & 0 \le t \le 3 \\ 2t+3 & 3 < t \le 4 \\ 12 & t > 4 \end{cases}$$

a) State any point of discontinuity.

b) Find if they exist

i, ~~ii~~ $\lim_{t \to 3} g$

Part (a)

State any point of discontinuity

Solution:-

At point $t = 3$ $g(t)$ is ~~g~~ not contineous because $g(3) = 9$

and $\lim_{t \to 3^+} g(t) = \lim_{t \to 3^-} g(t)$

So $\lim_{t \to 3}$ limit does not exist

In this case

Thus $t = 0$ is discontinuity point in the domain $g(t)$

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Q1) (B) Find if they exist

$\lim_{t \to 3} g$

Solution:

$g(0) = 0$ and

$\lim_{t \to 0} g(t) = 0$

and $\lim_{t \to 0} g(t) = 0$

i.e $\lim_{t \to 0} g(t) = \lim_{t \to 0} g(t)$

$\Rightarrow \lim_{t \to 0} g(t)$ exist

and $\lim_{t \to 0} g(t) = g(0)$

So $g(t)$ is contineous at point $t = 0$

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Q No (2)

i) Find the Maclaurin's Series for
$y(x) = x^2 + \sin x$

Solution:. $f(x) = x^2 + \sin x$

$f(0) = 0$ $\qquad = f'(0) = 2x + \cos x$

$f'(0) = 2(0) + \cos(0)$

$f'(0) = 1$

$f''(x) = 2 - \sin x$

$f''(0) = 2 - \sin(0)$

$f''(0) = 2$

$f'''(x) = -\cos x$

$f'''(0) = -\cos(0)$

$f'''(0) = -1$

Substituting these values in the formula

$$f(x) = f(0) + f'(0)x + f''(0)\,x^2 + \frac{f'''(0)\,x^3}{3!} + \cdots$$

$$x^2 + \sin x = 0 + 1x + \frac{2x^2}{2!} + \frac{(-1)x^3}{3!} + \cdots$$

$$x^2 + \sin x = x + x^2 - \frac{x^3}{6} + \cdots$$

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Q3 Part (a)

i) find y'' given

$$1 + xy = x^2 + y^2$$

$$d/dx\,(1) + d/dx\,xy = d/dx\,x^2 + d/dx\,y^2$$

$$0 + x\,dy/dx + y = 2x - y$$

$$x\frac{dy}{dx} - 2y\,dy/dx = 2x - y$$

$$\frac{dy}{dx}(x - 2y) = 2x - y$$

$$\frac{dy}{dx} = \frac{2x - y}{x - 2y}$$

Now taking second derivation using quatients formula

$$y'' = v \cdot u' - u \cdot v'$$

$$u = 2x - y$$
$$u' = 2$$
$$v = x - 2y$$
$$v' = 1$$

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put in formula

$$y'' = \frac{(x-2y)(2) - (2x-y)(1)}{(x-2y)^2}$$

$$y'' = \frac{\cancel{2x} - 4y \cancel{- 2x} + y}{(x-2y)^2}$$

$$y'' = \frac{-3y}{x-2y^2}$$

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Q. No (3) (Part B)

ii. Find y' by using logarithmic differentiat

$$Y = x^3 (1+x)^9 e^{6x}$$

Taking log on both side

$$\log y = \log x^3 (1+x)^9 e^{6x}$$

$$\frac{1}{y} \frac{d}{dx} = \frac{1}{x^3 (1+x)^9 e^{6x}} \frac{d}{dx} (x^3 (1+x)^9 e^{6x})$$

$$\frac{dy}{dx} = y' = \frac{y}{x^3 (1+x)^9 e^{6x}} \Big[x^3 (1+x)^9 \frac{d}{dx} e^{6x} + x^3 \cdot$$

$$e^{6x} \frac{d}{dx} (1+x)^9 + (1+x)^9 e^{6x} \frac{d}{dx} x^3 \Big]$$

$$\frac{y}{x^3 (1+x)^9 e^{6x}} \Big[x^3 (1+x)^9 (6e^{6x}) + 9x^3 e^{6x} (1+x)^8$$

$$+ 3x^2 e^{6x} (1+x)^9 \Big]$$

$$\frac{y}{x^3 (1+x)^9 e^{6x}} \Big[6x^3 e^{6x} (1+x)^9 + 9x^3 \cdot e^{6x} (1+x)^8 + 3x^2 e^{6x}$$

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$$\frac{y}{x^{7}(1+x)^{9}e^{6x}}\left(3\cancel{x^{7}}\cancel{e^{6x}}(1+x)^{8}(2x(1+x)^{9}+3x+(1+$$

$$\frac{y}{x(1+x)}\left(3(2x(1+x)^{9}+4x+1)\right)$$

$$\frac{3y\left[(2x(1+x)^{9}+4x+1)\right]}{x(1+x)}$$