Assignment

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① $\lim_{h \to 0} \frac{2(-3+h)^2 - 18}{h}$

$= \frac{2(9 + h^2 - 6h) - 18}{h}$

$= \frac{18 + 2h^2 - 12h - 18}{h}$

$= \frac{2h^2 - 12h}{h}$

$= \frac{h(2h - 12)}{h}$

$= 2h - 12$

$= -12$

② $g(x) \begin{cases} 2x & x < 6 \\ x - 1 & x \geq 6 \end{cases}$

a) $x = 4$

@ $x = 4$

$f(x)$ is continuous.

b) $x = 6$

LHL $\Rightarrow 12$

RHL $\Rightarrow 5$

$\therefore$ Discontinuous.

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(3) $\lim_{x \to 9} \frac{x-9}{3-\sqrt{x}}$

$= \frac{(\sqrt{x}-3)-1(\sqrt{x}+3)}{(3-\sqrt{x})}$

$= -3-\sqrt{x}$

$= -3-3$

$= -6$

(4) (a) $x = -1$

$f(x) = \frac{4x+5}{9-3x}$

$= \frac{-4+5}{9+3}$

$= \frac{1}{12}$

continuous

(b) $x = 0$

$f(x) = \frac{5}{9_0}$

continuous

(c) $f(x) = \infty$

discontinuous

(a)

(b) $\lim_{y \to 6} g(y) = 1 - 3(6)$

$= 1 - 18$

$= -17$

(b) $\lim_{y \to -2} g(y) \Rightarrow$

LHL $= y^2 + 5$

$= 4 + 5 = 9$

RHL $= 1 - (3x - 2)$

$= 1 - 6$

$= -5$

∴ Not continuous

(7) $f(t) = (4t^2 - t)(t^3 - 8t^2 + 12)$

$f'(t) = (8t - 1)(t^3 - 8t^2 + 12) + (4t^2 - t)(3t^2 - 16t)$

$= 8t^4 - 64t^3 + 96t - t^3 + 8t^2 - 12 + 12t^4 - 64t^3 - 3t^2 + 16t$

$= 20t^4 - 132t^3 + 24t^2 + 96t - 12$

$\log y = x \log 8$

$\frac{dy}{dx} = x \log 8^x$

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(8) $R(w) = \frac{3w + w^4}{2w^2 + 1}$

$R'(w) = \frac{(2w^2+1)(3+4w^3) - (3w+w^4)(4w)}{(2w^2+1)^2}$

$= \frac{(6w^2 + 8w^5 + 3 + 4w^3) - (12w^2 + 4w^5)}{4w^4 + 1 + 4w^2}$

$= \frac{-6w^2 + 4w^5 + 3 + 4w^3}{4w^4 + 1 + 4w^2}$

(9) $f'(x) = 2e^x + \frac{8^x \log 8}{\log 8}$

(10) $y = x^5 - e^x \log x$

$\frac{dy}{dx} = 5x^4 - \left[e^x \frac{1}{x} + \log x \, e^x \right]$

$= 5x^4 - \frac{e^x}{x} - \log x \cdot e^x$

(11) (a)

$f(x) = (6x^2 + 7x)^4$

$f'(x) = 4(6x^2 + 7x)^3 (12x + 7)$

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(b) $f(t) = 5 + (e)^{4t+t^7}$

$f'(t) = (e)^{4t+t^7} \times (4+7t^6)$

$= 4(e)^{4t+t^7} + 7t^6(e)^{4t+t^7}$

(12) (a) $z = \ln(7-x^3)$

$\frac{dz}{dx} = \frac{(-3x^2)}{(7-x^3)}$

$\frac{d^2z}{dx^2} = \frac{(7-x^3) \times (-6x) - (-3x^2)(-3x^2)}{(7-x^3)^2}$

$= \frac{-42x + 6x^4 - 9x^4}{(7-x^3)^2}$

$= \frac{-42x - 3x^4}{(7-x^3)^2}$

$$Q(v) = \frac{2}{(6+2v-v^2)^4}$$

$$Q'(v) = \frac{-8}{(6+2v-v^2)^5} \times (-2v+2)$$

$$= \frac{-8(2-2v)}{(6+2v-v^2)^5} = \frac{-16-16v}{(6+2v-v^2)^5}$$

$$Q''(v) = \frac{(6+2v-v^2)^5(-16) + (-16+16v)5(2+2v)(6+2v-v^2)^4}{(6+2v-v^2)^2}$$

$$= -96 - 32v + 16v^2 + \frac{}{(6+2v-v^2)^2}$$

(18)

$y = x^3 - 3x^2 - 9x + 12$

$\frac{dy}{dx} = 3x^2 - 6x - 9$

$= 3x^2 - 9x + 3x - 9$

$= 3x(x-3) + 3(x-3)$

$= (3x+3)(x-3)$

$x = -1$ (maxima) OR $x = 3$ (minima)

$\frac{d^2y}{dx^2} = 6x - 6$

$-6 - 6 = -12$