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HOMEWORK.

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

~~2(-3+~~

$\Rightarrow \dfrac{2(9+h^2-6h)-18}{h}$

$\Rightarrow \dfrac{\cancel{18}+2h^2-12h-\cancel{18}}{h}$

$\Rightarrow \dfrac{2\cancel{h}(h-6)}{\cancel{h}}$

$\Rightarrow \lim_{h\to 0} 2h-12$

$\Rightarrow \underline{\underline{-12}}$

2) a) $x = 4$
b) $x = 6$.

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

~~a) $x-1 \Rightarrow 4-1 \Rightarrow 3$ x~~

a) $x = 4$.
* continous, all polynomials are continous *
Can be only discont. when its def is changing

b) $x = 6$

LHL $= 2\times 6$.
$= 12$

RHL. $= 6-1$
$= 5$

$\therefore$ discontinous

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

$\lim_{x \to 9} \frac{(\sqrt{x})^2 - 3^2}{3 - \sqrt{x}}$

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

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

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

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

$\Rightarrow -3-3$

$\Rightarrow -6$

4) a) $x = -1$

b) $x = 0$

c) $x = 3$

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

a) $x = -1$

$\frac{-4+5}{9-3(-1)} \Rightarrow \frac{1}{12} \Rightarrow$ continous

b) $x = 0$

$\frac{4(0)+5}{9-3(0)} = \frac{5}{9} \Rightarrow$ continous

c) $x = 3$. $\frac{4(3)+5}{9-3(3)} = \frac{12+5}{0} \Rightarrow$ discontinous

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5) $$\lim_{x\to\infty} \frac{6e^{4x} - e^{-2x}}{8e^{4x} - e^{2x} + 3e^{-x}}$$

$$\boxed{\lim_{x\to\infty} \frac{e^{-2x}(6e^{6x} - 1)}{e^{-2x}(8e^{6x} - e^{4x} + 3e^{x})}}$$

$$\Rightarrow \lim_{x\to\infty} \frac{6\frac{e^{4x}}{e^{4x}} - \frac{e^{-2x}}{e^{4x}}}{8\frac{e^{4x}}{e^{4x}} - \frac{e^{2x}}{e^{4x}} + \frac{3e^{-x}}{e^{4x}}}$$

$$\Rightarrow \lim_{x\to\infty} \frac{6 - 1}{(e^{6x})\left(8 - \frac{1}{e^{2x}} + \frac{3}{e^{5x}}\right)} \quad \frac{1}{\infty} \times (6 - 1)$$

6) $$g(y) = \begin{cases} y^2 + 5 & \text{if } y < -2 \\ 1 - 3y & \text{if } y \geq -2 \end{cases}$$

5) $$\lim_{x\to\infty} \frac{6e^{4x} - e^{-2x}}{8e^{4x} - e^{2x} + 3e^{-x}}$$

$$\Rightarrow \lim_{x\to\infty} \frac{6e^{4x}/e^{4x} - e^{-2x}/e^{4x}}{8e^{4x}/e^{4x} - e^{2x}/e^{4x} + 3e^{-x}/e^{4x}}$$

$$\Rightarrow \lim_{x\to\infty} \frac{\cancel{(6-1)}\,(6 - 1/e^{6x})}{\left(8 - \frac{1}{e^{2x}} + \frac{3}{e^{5x}}\right)}$$

$$\Rightarrow \cancel{\frac{1}{\infty} = 0} \qquad \frac{6 - 0}{8 - 0 + 3(0)}$$

$$\Rightarrow \frac{3\cancel{6}}{4\cancel{8}} = \frac{3}{4} \text{ ans}$$

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5) $\lim_{x \to \infty} \dfrac{6e^{4x} - e^{-2x}}{8e^{4x} - e^{2x} + 3e^{-x}}$

$\boxed{\lim_{x\to\infty} \dfrac{e^{-2x}(6e^{6x} - 1)}{e^{-2x}(8e^{6x} - e^{4x} + 3e^{x})}}$

$\Rightarrow \lim_{x\to\infty} \dfrac{6\dfrac{e^{4x}}{e^{4x}} - \dfrac{e^{-2x}}{e^{4x}}}{8\dfrac{e^{4x}}{e^{4x}} - \dfrac{e^{2x}}{e^{4x}} + \dfrac{3e^{-x}}{e^{4x}}}$

$\Rightarrow \lim_{x\to\infty} \dfrac{6-1}{(e^{6x})\left(8 - \dfrac{1}{e^{2x}} + \dfrac{3}{e^{5x}}\right)}$ $\dfrac{1}{\infty} \times (6-1)$

6) $g(y) = \begin{cases} y^2+5 & \text{if } y < -2. \\ 1-3y & \text{if } y \geq -2 \end{cases}$

5) $\lim_{x\to\infty} \dfrac{6e^{4x} - e^{-2x}}{8e^{4x} - e^{2x} + 3e^{-x}}$.

$\Rightarrow \lim_{x\to\infty} \dfrac{6e^{4x}/e^{4x} - e^{-2x}/e^{4x}}{8e^{4x}/e^{4x} - e^{2x}/e^{4x} + 3e^{-x}/e^{4x}}$.

$\Rightarrow \lim_{x\to\infty} \dfrac{\cancel{(6-1)}\ (6 - 1/e^{6x})}{\left(8 - \dfrac{1}{e^{2x}} + \dfrac{3}{e^{5x}}\right)}$

$\Rightarrow$ $\cancel{\dfrac{1}{\infty} = 0}$ $\dfrac{6-0}{8-0+3(0)}$

$\Rightarrow \dfrac{3\cancel{6}}{4\cancel{8}} = \dfrac{3}{4}$ ans

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6) $g(y) = \begin{cases} y^2+5 & \text{if } y < -2 \\ 1-3y & \text{if } y \geq -2 \end{cases}$

a) $\lim_{y \to 6} g(y)$

$\Rightarrow \lim_{y \to 6} 1-3y$

$\Rightarrow 1-3(6)$

$\Rightarrow -17$

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

~~$\Rightarrow \lim_{y \to -2}$~~

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

~~lim g(y)~~

LHL $\Rightarrow y^2+5$

$\Rightarrow (-2)^2+5$

$\Rightarrow 4+5$

$\Rightarrow 9$

RHL $\Rightarrow 1-3y$

$1-3(-2)$

$1+6$

7

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

$\Rightarrow \frac{d(f(t))}{dt}$

$\Rightarrow (4t^2-t)[3t^2-16t]+(t^3-8t^2+12)(8t-1)$

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

$\Rightarrow 20t^4-132t^3+16t^2+96t-12$

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6) $g(y) = \begin{cases} y^2+5 & \text{if } y<-2 \\ 1-3y & \text{if } y \geq -2 \end{cases}$

a) $\lim_{y\to 6} g(y)$

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

$\Rightarrow \lim_{y\to 6} 1-3y$

$\Rightarrow 1-3(6)$

$\Rightarrow -17$

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

~~lim g(y)~~

LHL $\Rightarrow y^2+5$

$\Rightarrow (-2)^2+5$

$\Rightarrow 4+5$

$\Rightarrow 9$

RHL $\Rightarrow 1-3y$

$1-3(-2)$

$1+6$

7

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

$\Rightarrow df(t)/dt$

$\Rightarrow (4t^2-t)\left[3t^2-16t\right]+(t^3-8t^2+12)(8t-1)$

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

$\Rightarrow 20t^4-132t^3+16t^2+96t-12$

$\frac{6}{64}$

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

$\Rightarrow$ ~~$4t^4 - 32t^4$~~

$\Rightarrow$ ~~$4t^6$~~

$\Rightarrow 4t^5 - 32t^4 + 48t^2 - t^4 + 8t^3 \; 12t$

$\Rightarrow 20t^4 - 128t^3 + 96t - 4t^3 + 24t^2 - 12$

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

8) $R(\omega) = \dfrac{3\omega + \omega^4}{2\omega^2 + 1}$

$\Rightarrow \dfrac{3\omega + \omega^4 (4\omega) - (2\omega^2 + 1)(3 + 4\omega^3)}{(2\omega^2 + 1)^2}$

$\Rightarrow$ ~~$\dfrac{3\omega + 4\omega^5 \quad \omega^2 - 1}{3\omega + \omega^4}$~~

$\Rightarrow 3\omega + 4\omega^5 - [6\omega^2 + 8\omega^5 + 3 + 4\omega^3)$

$\Rightarrow 3\omega + 4\omega^5 - 6\omega^2 - 8\omega^5 - 3 - 4\omega^3$

$\Rightarrow -4\omega^5 - 4\omega^3 - 6\omega^2 + 3\omega - 3$ //

9) $f(x) = 2e^x - 8^x$

$2e^x - 8^x \log 8$

10) $y = z^5 - e^z \ln(z)$

$\cancel{z^5 \log z \quad 5z^4 - e^z \ln dz}$

$$\frac{dy}{dz} = 5z^4 - \left(\frac{e^z}{z} + \ln(z) \times e^z\right)$$

$$\frac{dy}{dz} = 5z^4 - \frac{e^z}{z} + \ln(z)e^z$$

$$\frac{dy}{dz} = 5z^4 - \frac{e^z}{z} + \ln(z)e^z.$$

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

$\Rightarrow \quad 4(6x^2 + 7x)(12x + 7).$

$\Rightarrow \quad 4(72x^3 + 42x^2 + 84x^2 + 49x)$

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

$= 0 + e^{(4t+t^7)}(4 + 7t^6)$

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

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

$\Rightarrow \frac{d\cancel{y}z}{dx} \Rightarrow \frac{1}{(7 - x^3)}$

$\Rightarrow \frac{dz}{dx} \Rightarrow \frac{-1}{(7-x^3)^2}(-3x^2).$

* b) $Q(v) = \dfrac{2}{(6+2v-v^2)^4}$

$= \cancel{\dfrac{2}{4}}$

$\Rightarrow 2(6+2v-v^2)^{-4}$

$\Rightarrow 2(-4)(6+2v-v^2)^{-5}(2-2v)$

$\Rightarrow \dfrac{-8(2-2v)}{(6+2v-v^2)^{-5}} \Rightarrow \dfrac{-16(1-v)}{(6+2v-v^2)^5}$

$-16(1-v)(6+2v-v^2)^4(0+2-2v)$

* c) $f(t) = \ln(1+t^2)$

$\Rightarrow \dfrac{1}{1+t^2}(2t)$

$\Rightarrow \dfrac{2t}{1+t^2} \Rightarrow \dfrac{2t(0+2t)-(1+t^2)\times 2}{(1+t^2)^2}$

$\Rightarrow \cancel{4t^2 \quad 1+t^4+2t^2} \quad \dfrac{4t^2-2-2t^2}{(1+t^2)^2}$

$\Rightarrow \dfrac{2t^2-2}{(1+t^2)^2}$

13) $x^3-3x^2-9x+12$

$3x^2-6x-9=0$

$x^2-2x-3=0$

$x^2-3x+x-3=0$

$x(x-3)+(x-3)=0$

$(x+1)(x-3)=0$

$x=-1,\ x=3$

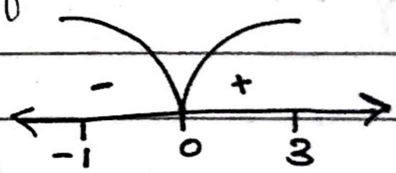
$f''(x) = 6x-6$

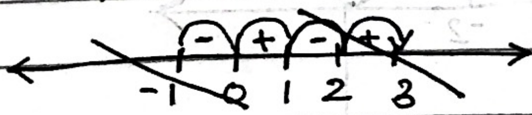
$f''(-1) = -6-6 = -12$

$f''(3) = 18-6 = 12$

$f(-1) = -1-3+9+12 = 17$

(max val)





$f(3) = 27-27-27+1$

mi

$4x^3 - 18x^2 + 24x - 7$

$\cancel{12x^3 - 36x^2 + 24 = 0}$.

$\cancel{x^3 - 3x^2}$

$12x^2 - 36x + 24 = 0$.

$x^2 - 3x + 2 = 0$.

$x^2 - x - 2x + 2 = 0$

$x(x-1) - 2(x-1) = 0$

$(x-2)(x-1) = 0$

$x = 2, x = 1$

$f'(x) = 12x^2 - 36x + 24$

$f''(x) = 24x - 36$

$f''(x) = 48 - 36 = 12$

$f''(1) = 24 - 86 = -12$

$f(1) = 4 - 18 + 24 - 7 = 3$

max value

$f(2) = 32 - 72 + 48 - 7$

$= 1$

min val.

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

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

$f'(x) = 3x^2 + 6x = 0$.

$x^2 + 2x = 0$.

$x(x+2) = 0$.

$x = 0, x = -2$.

$f''(x) = 6x + 6$

$f''(0) = 6$ $f''(-2) = -6$

At 0, $f(x)$ lies minimum val & at -2 $f(x)$ has maximum val

$f(x) = 3x^2 - 6x = 6x - 6 = 6(x-1)$

$f'(1) =$