STS2005(09)	미적분학 I(HW1)	Due Date(2020. 3/21)

No : ________ 학과 : 경제학 / 컴퓨터공학 학번 : 20160563 이름 : 송진아

1. Evaluate the limit:

(1) $\lim_{x\to -1} \frac{2x^2+3x+1}{x^2-2x-3} = \lim_{x\to -1} \frac{(2x+1)\cancel{(x+1)}}{(x-3)\cancel{(x+1)}} = \frac{-1}{-4} = \frac{1}{4}$

인수분해

(2) $\lim_{x\to 16} \frac{4-\sqrt{x}}{16x-x^2} = \lim_{x\to 16} \frac{4-\sqrt{x}}{x(16-x)} = \lim_{x\to 16} \frac{\cancel{4-\sqrt{x}}}{x(\cancel{4-\sqrt{x}})(4+\sqrt{x})} = \frac{1}{16\cdot 8} = \frac{1}{128}$

인수분해 유리화

(3) $\lim_{x\to\infty} \frac{\sqrt{9x^6-x}}{x^3+1} = \lim_{x\to\infty} \frac{\sqrt{\frac{9x^6-x}{x^6}}}{1+\frac{1}{x^3}} = \lim_{x\to\infty} \frac{\sqrt{9-\underbrace{\frac{1}{x^5}}_{\to 0}}}{1+\underbrace{\frac{1}{x^3}}_{\to 0}} = 3$

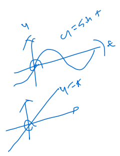
(4) $\lim_{x\to\infty} \frac{1-\overbrace{e^x}^{\to\infty}}{1+2e^x} = \lim_{x\to\infty} \frac{\overbrace{\frac{1}{e^x}}^{\to 0}-1}{\underbrace{\frac{1}{e^x}}_{\to 0}+2} = -\frac{1}{2}$

$\frac{\sin\theta}{\cos\theta}$

(5) $\lim_{t\to 0} \frac{\tan(6t)}{\sin(2t)} = \lim_{t\to 0} \frac{\sin(6t)}{\sin(2t)\cdot\cos(6t)} = \lim_{t\to 0} \frac{3\overbrace{\frac{\sin(6t)}{6t}}^{\to 1}}{\underbrace{\frac{\sin(2t)}{2t}}_{\to 1}\underbrace{\cos(6t)}_{\to 1}} = 3$

$* \lim_{t\to 0} \frac{\sin(t)}{t} = 1$

$* \tan\theta = \frac{\sin\theta}{\cos\theta}$



(6) $\lim_{\theta\to 0} \frac{\cos(\theta)-1}{\sin(\theta)} = \lim_{\theta\to 0} \frac{\overbrace{\frac{\cos(\theta)-1}{\theta}}^{\to 0}}{\underbrace{\frac{\sin(\theta)}{\theta}}_{\to 1}} = 0$

$* \lim_{\theta\to 0} \frac{1-\cos(\theta)}{\theta} = 0$

ㄴ pf) $\lim_{\theta\to 0} \frac{(1-\cos(\theta))(1+\cos(\theta))}{\theta(1+\cos(\theta))} = \lim_{\theta\to 0} \overbrace{\frac{\sin(\theta)}{\theta}}^{\to 1} \cdot \frac{\overbrace{\sin(\theta)}^{\to 0}}{\underbrace{1+\cos(\theta)}_{\to 2}} = 0$

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2. Differentiate the function:

(1) $y = 3e^x + \dfrac{4}{\sqrt[3]{x}}$ ($x^{\frac{1}{3}}$)

$$y' = 3e^x + 4\cdot\left(-\tfrac{1}{3}\right)x^{-\frac{1}{3}-1}$$
$$= 3e^x - \tfrac{4}{3}x^{-\frac{4}{3}}$$

(2) $f(x) = \dfrac{1 - xe^x}{x + e^x}$ 공식사용

$$f'(x) = \frac{(1-xe^x)'(x+e^x) - (1-xe^x)(x+e^x)'}{(x+e^x)^2}$$

$$= \frac{-(e^x+xe^x)(x+e^x) - (1-xe^x)(1+e^x)}{(x+e^x)^2}$$

$* \left(\dfrac{f}{g}\right)' = \dfrac{f'g - fg'}{g^2}$

$* (fg)' = f'g + fg'$

(3) $f(x) = (1 + x^4)^{2/3}$ 합성함수 (chain-rule)

$$f'(x) = \tfrac{2}{3}(1+x^4)'(1+x^4)^{\frac{2}{3}-1}$$
$$= \tfrac{8}{3}x^3(1+x^4)^{-\frac{1}{3}}$$

(4) $y = e^{-2t}\cos(4t)$ chain rule

$$y' = (e^{-2t})'\cos(4t) + e^{-2t}(\cos(4t))'$$
$$= -2e^{-2t}\cos(4t) - 4e^{-2t}\sin(4t)$$

(5) $f(t) = \tan(e^t) + e^{\tan(t)}$ tan 도함수, 합성

$$f'(t) = e^t\sec^2(e^t) + \sec^2(t)e^{\tan(t)}$$

$\dfrac{1}{\sin} = \csc$ $= \dfrac{1}{\cos^2} = \sec^2$

$\dfrac{1}{\cos} = \sec$

$\dfrac{1}{\tan} = \cot$

(6) $f(x) = x\ln(x) - x$

$$f'(x) = \ln(x) + 1 - 1$$
$$= \ln(x)$$

ln x 도함수

(7) $y = \ln(e^{-x} + xe^{-x})$ +합성

$$y' = \frac{(e^{-x}+xe^{-x})'}{e^{-x}+xe^{-x}} = \frac{-\cancel{e^{-x}}+\cancel{e^{-x}}-xe^{-x}}{e^{-x}+xe^{-x}}$$

$$= \frac{-xe^{-x}}{e^{-x}+xe^{-x}} = \frac{-x}{1+x}$$