ⓙ $$f'(x) = \frac{\overset{D}{(x+2)}\,\overset{N'}{\left[x\overset{1}{\cancel{e^x}} + \overset{1}{\cancel{e^x}}\right]} - \overset{N}{x\cancel{e^x}} \cdot \overset{D'}{(1)}}{(x+2)^2}$$

$$= \frac{e^x\left[(x+2)(x+1) - x\right]}{(x+2)^2}$$

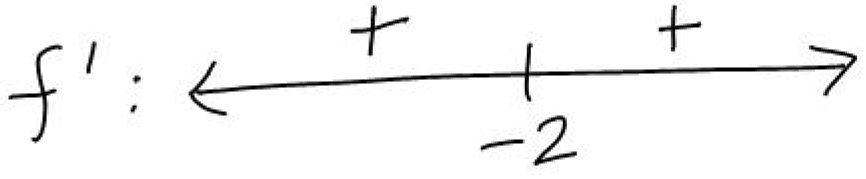
$$= \frac{\overbrace{e^x}^{\text{pos.}}\overbrace{\left(x^2 + 2x + 2\right)}^{\leftarrow \Delta = 4 - 8}}{(x+2)^2}$$

What are the <u>critical</u> <u>values</u> of f?

(values that make f' zero or undefined)

$x = -2$ (f' is undefined)

f' :



$y = \frac{x \cdot e^x}{x+2}$ is increasing everywhere is defined.

D ·   N'

ⓔ $f'_{(x)} = \dfrac{\cancel{e^x}\left[x \cdot \cos x + \sin x\right] - x \cdot \sin x \cdot \cancel{e^x}}{\cancel{e^{2x}}\ e^x}$

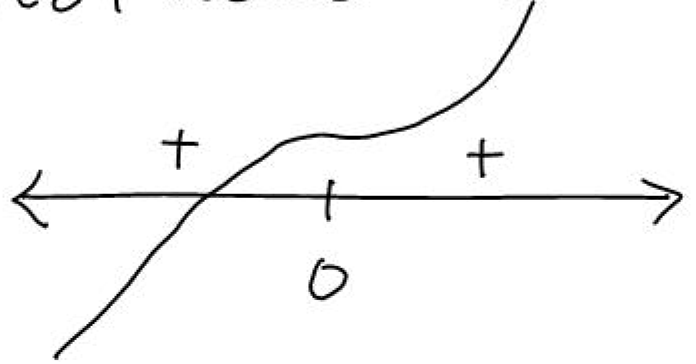
ⓕ $f'(x) = \dfrac{(x^2+1)(3x^2) - x^3(2x)}{(x^2+1)^2}$

$= \dfrac{x^2\left(3x^2+3-2x^2\right)}{(x^2+1)^2}$

$= \dfrac{x^2\left(x^2+3\right)}{(x^2+1)^2} \geq 0$

critical value : $x = 0$ no extrema

$f'(x)$:



HW quiz 10-23

$$\frac{d}{dx}\left[\frac{x^2}{2x+1}\right] = \frac{(2x+1)(2x) - x^2(2)}{(2x+1)^2}$$

$$= \frac{x(4x+2-2x)}{(2x+1)^2}$$

$$= \frac{x(2x+2)}{(2x+1)^2} \quad \text{or} \quad \frac{2x(x+1)}{(2x+1)^2}$$

#3 $f'(x) = -\sin(x^2-1)\cdot 2x$

$= -2x\cdot\sin(x^2-1)$

#7 $f'(x) = \sec^2(x^4)\cdot 4x^3$

#11 $f'(x) = -\csc(5x+2)\cot(5x+2)\cdot 5$

#15

#15 $f(x) = \left[\underline{\tan}\left(e^{x^3}\right)\right]^{3 \swarrow}$

$$f'(x) = \underbrace{3\left[\tan\left(e^{x^3}\right)\right]^2} \cdot \underbrace{\sec^2\left(e^{x^3}\right)} \cdot \underbrace{e^{x^3} \cdot 3x^2}$$

$$= 9x^2 e^{x^3} \cdot \tan^2\left(e^{x^3}\right) \cdot \sec^2\left(e^{x^3}\right)$$

#19.

$$f'(x) = e^{x^2} \cdot \overbrace{\left(-\sin(2x)\right) \cdot 2}^{\text{chain rule}} + \cos(2x) \cdot \overbrace{e^{x^2} \cdot 2x}^{\text{chain rule}}$$

$$= 2e^{x^2}\left[x \cdot \cos 2x - \sin 2x\right]$$

#1 $f'(x) = 3(x-3)^2$

#5 $f'(x) = \frac{1}{2}(x^3+4)^{-1/2} \cdot 3x^2$

$$= \frac{3x^2}{2\sqrt{x^3+4}}$$

#9 $f'(x) = \sec(e^x)\tan(e^x) \cdot e^x$

#13 $f'(x) = \overbrace{\underset{\uparrow}{3}\,\underline{\cos}^2(x^2)} \cdot \overbrace{-\underline{\sin}(x^2)} \cdot \overbrace{\underline{2}\underset{\uparrow}{x}}$

$$= -3x \cdot \sin(2x^2)\cos(x^2)$$

$$\boxed{2\sin\theta\,\underline{\cos\theta} = \sin 2\theta}$$

#17

$$f'(x) = \frac{(x-5)^4 \cdot 3(x+3)^2 - (x+3)^3 \cdot 4(x-5)^3}{(x-5)^8}$$

$$= \frac{\cancel{(x-5)^3}(x+3)^2\left[3(x-5) - 4(x+3)\right]}{(x-5)^{\cancel{8}\,5}}$$

$$= \frac{(x+3)^2\ (-x-27)}{(x-5)^5}$$

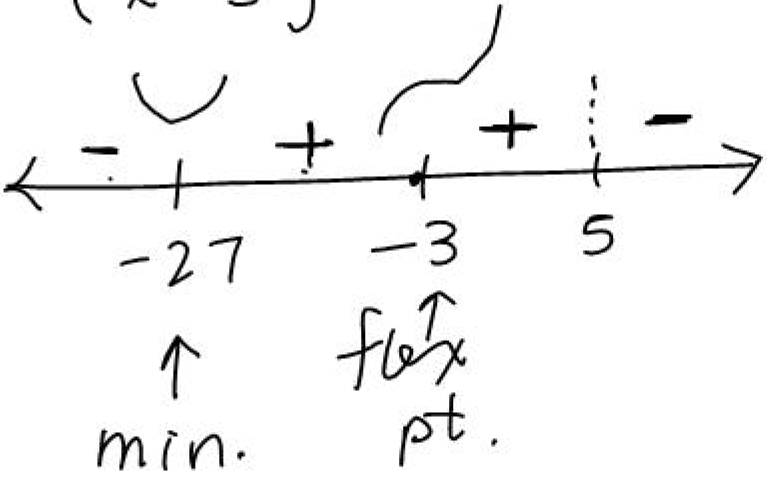
C.V.

5 (VA)

-3

-27

$f'(x)$:



#20

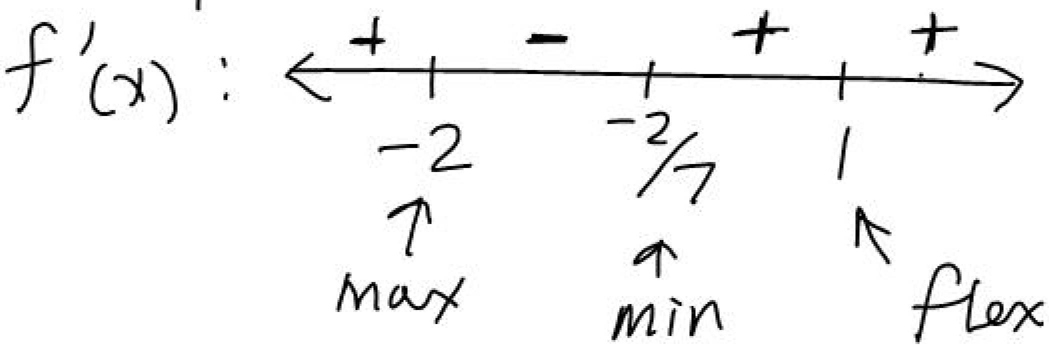
$$f'(x) = (x-1)^3 \cdot 4(x+2)^3 + (x+2)^4 \cdot 3(x-1)^2$$

$$= (x-1)^2 (x+2)^3 \left[4(x-1) + 3(x+2) \right]$$

$$= \underbrace{(x-1)^2}_{\text{pos.}} (x+2)^3 (7x+2)$$

critical values

$1, -2, -2/7$



#21.

point: $(-2, f(-2)) = (-2, 0)$

slope: $f'(x) = \dfrac{(x+5) - (x+2)}{(x+5)^2} = \dfrac{3}{(x+5)^2}$

$$f'(-2) = \frac{3}{(-2+5)^2} = \frac{1}{3}$$

Tangent Line: $y - 0 = \frac{1}{3}(x+2)$

$$\boxed{y = \frac{1}{3}x + \frac{2}{3}}$$

point-slope form

$$m = \frac{y - y_0}{x - x_0}$$

$$y - y_0 = m(x - x_0)$$

Tangent line $(-1, 1/3)$

$$f(-1) \approx \boxed{\frac{1}{3}(-1) + \frac{2}{3} = \frac{1}{3}}$$

Actual

$(-1, 1/4)$

$$\% \text{error} = \frac{\left| \frac{1}{3} - f(-1) \right|}{f(-1)} \times 100$$

$$f(-1) = \frac{-1+2}{-1+5} = \frac{1}{4}$$

$$\frac{\frac{1}{3} - \frac{1}{4}}{\frac{1}{4}} \times 100$$

$= 33\%$

HW

chain rule columns 2,4

#22ab