

# HW quiz 10-17

Find  $\frac{dy}{dx}$ .

$$\textcircled{1} \quad y = 4x^3 - 2x^2 + 3 - \frac{1}{x}$$

$$\textcircled{2} \quad y = \sqrt[4]{x}$$

#2

$$\begin{aligned} \textcircled{a} \quad f(x) &= x \cdot (-\sin x) + \cos x \cdot 1 \\ &= -x \cdot \sin x + \cos x \end{aligned}$$

$$\textcircled{b} \quad f'(x) = x^2 \cdot \cos x + \sin x \cdot 2x$$

$$\textcircled{b} \quad f(x) = x^2 \cdot \sin x$$

Diagram illustrating the product rule for  $f(x) = x^2 \cdot \sin x$ . Arrows point from  $x^2$  to  $\sin x$  and from  $\sin x$  to  $2x$ . A curved arrow labeled "deriv." spans from  $x^2$  to  $2x$ . A larger curved arrow labeled "deriv." spans from  $x^2$  to  $\sin x$ .

$$\begin{aligned} \textcircled{c} \quad f'(x) &= x^3 \cdot e^x + e^x \cdot 3x^2 \\ &= x^2 e^x (x + 3) \end{aligned}$$

$$\begin{aligned} \textcircled{d} \quad f'(x) &= e^x \cdot \cos x + \sin x \cdot e^x \\ &= e^x (\cos x + \sin x) = 0 \end{aligned}$$

$$x = \frac{3\pi}{4}, \frac{7\pi}{4}, \dots$$

$$\textcircled{e} \quad f'(x) = e^x (-\sin x) + \cos x \cdot e^x \\ = e^x (\cos x - \sin x)$$

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$$\frac{d}{dx} [\cos x]$$

$$= \lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cos x \cos h - \sin x \sin h - \cos x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{\cos x} (\cos h - 1)}{h} + \lim_{h \rightarrow 0} \frac{-\sin x \sin h}{h}$$

$$= -\sin x$$

# The Quotient Rule

$$\frac{d}{dx} \left[ \frac{u}{v} \right] = \frac{v \cdot \frac{du}{dx} - u \cdot \frac{dv}{dx}}{v^2}$$

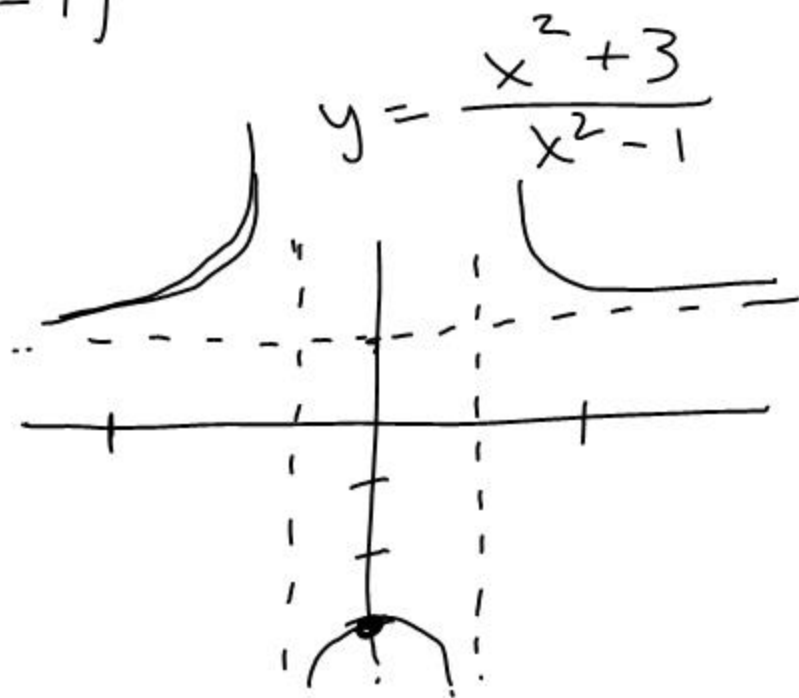
Ex  $\frac{d}{dx} \left[ \frac{x^2 + 3}{x^2 - 1} \right]$

$$= \frac{(x^2 - 1)(2x) - (x^2 + 3)(2x)}{(x^2 - 1)^2}$$

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

$$= \frac{-8x}{(x^2 - 1)^2}$$

$$y = \lim_{x \rightarrow \infty} \frac{x^2 + 3}{x^2 - 1} = 1$$



$$\frac{Ex}{f(x)} = \frac{e^x}{\sin x}$$

$$f'(x) = \frac{\sin x \cdot e^x - e^x \cdot \cos x}{\sin^2 x}$$

$$= \frac{e^x (\sin x - \cos x)}{\sin^2 x}$$

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$$f(x) = \frac{\sin x}{\cos x} = \tan x$$

$$f'(x) = \frac{\cos x \cdot \cos x - \sin x \cdot (-\sin x)}{\cos^2 x}$$

$$= \frac{\cos^2 x + \sin^2 x}{\cos^2 x} = \frac{1}{\cos^2 x}$$

$$= \sec^2 x$$

# HW Quotient Rule

# 3

factor the numerator if poss.

(i) use the prod + quot. rules