#14. $6x - 5$ #15. $-1 - 2x - 12x^2$

#17. $6x + 4 + \frac{1}{x^2}$ #18. $\frac{-6}{x^3} + \frac{12}{x^4}$

#19. $1 - \frac{1}{x^2}$

#21. $\frac{-1}{4x^{3/2}} + \frac{6}{x^4}$

#22. $\frac{4}{5x^{1/5}} - \frac{2}{x^{3/5}} + \frac{2}{x^{4/5}}$

#21. $f(x) = \frac{1}{2\sqrt{x}} - \frac{2}{x^3} = \frac{1}{2}x^{-1/2} - 2x^{-3}$

$f'(x) = -\frac{1}{4}x^{-3/2} + 6x^{-4}$

$= \frac{-1}{4x^{3/2}} + \frac{6}{x^4}$

(e) $f(x) = e^x \cdot \cos x$

$$f'(x) = e^x(-\sin x) + \cos x \cdot e^x$$

$$= e^x(\cos x - \sin x) = 0$$

$$x = \frac{\pi}{4}, \frac{5\pi}{4}, \cdots$$

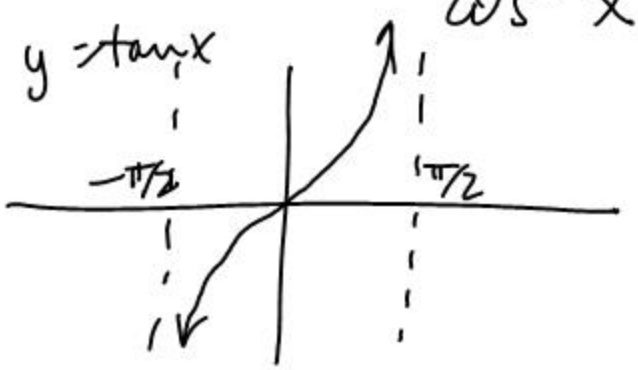
$(\cos x)^2 = \cos^2 x$

(f) $f(x) = \dfrac{\sin x}{\cos x} = \tan x \neq \cos x^2$

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

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

$$= \frac{1}{\cos^2 x} = \underline{\sec^2 x} > 0$$



The Chain Rule (for composite functions)

$$f(g(x)) = \sqrt{3x+2}$$

outer function $\rightarrow f(x) = \sqrt{x}$

inner function $\rightarrow g(x) = 3x+2$

The Chain Rule

If $f(x) = u(v(x))$

then $f'(x) = u'(v(x)) \cdot v'(x)$

Ex. $f(x) = \sqrt{3x+2} = (3x+2)^{1/2}$

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

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

Ex. $f(x) = \cos(x^2 - 2)$

outer: $\cos$; inner: $x^2 - 2$

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

Ex. $f(x) = e^{8x+2} = \exp(8x+2)$ ← inner function: $8x+2$

$$f'(x) = e^{8x+2} \cdot 8$$

Ex. $g(x) = x^2 \cdot e^{x^3}$

$$g'(x) = x^2 \cdot e^{x^3} \cdot 3x^2 + e^{x^3} \cdot 2x$$

$$= x e^{x^3}(3x^3 + 2)$$

$y = e^{x^2}$

$y' = x^2 e^{x^2 - 1}$

$y = x^3$ ← power of x

$y' = 3x^2$

"blob"

EX. $f(x) = 3(4x^2 - 5)^8$

$$f'(x) = 24(4x^2-5)^7 \cdot 8x$$

$$= 192x(4x^2-5)^7$$

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

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

$$= \frac{-(\sin^2 x + \cos^2 x)}{\sin^2 x} = \frac{-1}{\sin^2 x} = -\csc^2 x$$

$f(x) = \sec x \longrightarrow f'(x) = \sec x \cdot \tan x$

$f(x) = \csc x \longrightarrow f'(x) = -\csc x \cdot \cot x$

HW Chain Rule #1 - 11

Turn in Quotient Rule #3 i, R, l