$$\frac{d}{dx} e^x = e^x \qquad \frac{d}{dx} \ln x = \frac{1}{x}$$

$$\frac{d}{dx} a^x = a^x \ln a \qquad \frac{d}{dx} \log_a x = \frac{1}{x \ln a}$$

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deriv of $\quad x^2\, 3^{5x-7}$

prod rule: $\quad x^2 \cdot 3^{5x-7} \cdot \ln 3 \cdot 5 + 3^{5x-7} \cdot 2x$

$5x^{1/2}$

$\downarrow$

deriv of: $8 \log_2 \left(7x^2 - 5\sqrt{x} \right)$

$$8 \cdot \frac{1}{(7x^2 - 5\sqrt{x}) \ln 2} \cdot \left(14x - 5 \cdot \tfrac{1}{2} x^{-1/2} \right)$$

$$\cancel{8 \cdot 1 / (7x^2 - 5\sqrt{x}) \ln 2 \cdot (14x - 5 \cdot \tfrac{1}{2} x^{-1/2})}$$

Give x-values where the slope is 3 for:

$f(x) = 2x^2 - 7x + 4$

$f'(x) = 4x - 7$

$4x - 7 = 3$

$4x = 10$

$x = 10/4 = 2.5$

$f(x) = 2x\,e^{1-3x}$ give intervals where it's inc/dec.

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

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

$= \boxed{e^{1-3x}(-6x+2)} = 2e^{1-3x}(-3x+1)$

$f' = 0$: $e^{1-3x} \cdot (-6x+2) = 0$

f' DNE: N/A

$e^{1-3x} = 0$ or $-6x+2 = 0$

N/A

$2 = 6x$

$x = 1/3$

$+ \quad 1/3 \quad -$

$f'(0) = e^{1-3\cdot 0}(-6\cdot 0+2) = +$

$+ \cdot +$

$$f'(1) = e^{1-3\cdot 1}(-6\cdot 1+2)$$

$$+ \quad \cdot \quad -$$

f is increasing on $(-\infty, 1/3)$

decreasing on $(1/3, \infty)$

$$\frac{d}{dx}\left(e^{\underbrace{x^2}\underbrace{\sqrt{x+1}}}\right) = \frac{d}{dx}\left(e^{\underbrace{x^2}\underbrace{(x+1)^{1/2}}}\right)$$

$$= e^{x^2(x+1)^{1/2}} \cdot \frac{d}{dx}\left(x^2\cdot(x+1)^{1/2}\right)$$

$$= e^{x^2(x+1)^{1/2}} \cdot \left(x^2 \cdot \tfrac{1}{2}(x+1)^{-1/2}\cdot 1 + (x+1)^{1/2}\cdot 2x\right)$$

For $f(x) = \sqrt{7x^2 + 5/x - 8x^{10}}$,

find $f'(2)$.

first do $f'(x)$, then plug in $x=2$.

$$f(x) = (7x^2 + 5/x - 8x^{10})^{1/2}$$

$5x^{-1} \to -5x^{-2}$

$$f'(x) = \frac{1}{2}\left(7x^2 + 5/x - 8x^{10}\right)^{-1/2} \cdot \left(14x - 5x^{-2} - 80x^9\right)$$

so $$f'(2) = \frac{1}{2}\left(7\cdot 2^2 + 5/2 - 8\cdot 2^{10}\right)^{-1/2} \cdot \left(14\cdot 2 - 5\cdot 2^{-2} - 80\cdot 2^9\right)$$

$\log_5 25 = ?$

means $5^{?} = 25$

so $\log_5 25 = 2$

$\log 50 = ?$

$10^{?} = 50$

can't do by hand.

$\log_5 \frac{1}{125} = ?$

$5^{?} = \frac{1}{125}$ $? = -3$

$\log_5 \frac{1}{125} = -3.$

$5^x = 100$ solve for x in terms of ln of something.

$\downarrow$

$\ln 5^x = \ln 100$

$x \ln 5 = \ln 100$

$x = \frac{\ln 100}{\ln 5}$

$$2^x = 3^{1-4x}$$

$$\ln 2^x = \ln 3^{1-4x}$$

$$x\ln 2 = (1-4x)\ln 3$$

$$x\ln 2 = \ln 3 - 4x\ln 3$$

$$x\ln 2 + 4x\ln 3 = \ln 3$$

$$x(\ln 2 + 4\ln 3) = \ln 3$$

$$x = \frac{\ln 3}{\ln 2 + 4\ln 3}$$

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deriv of $\dfrac{5x^2 + 7x}{x^4}$ (no quot. rule)

$$(5x^2 + 7x)\, x^{-4}$$

$$5x^{-2} + 7x^{-3}$$

deriv. is: $-10x^{-3} - 21x^{-4}$