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

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

---

inc / dec for:

$$f(x) = \underbrace{(5-3x)}\,\underbrace{e^{2x}}$$

$$\boxed{\begin{aligned} f'(x) &= (5-3x)\cdot e^{2x}\cdot 2 + e^{2x}\cdot -3 \\ &= e^{2x}\left((5-3x)\cdot 2 + -3\right) \end{aligned}}$$

$$= e^{2x}(10-6x-3)$$

$$\boxed{f'(x) = e^{2x}(7-6x)}$$

$f'=0$: $\quad e^{2x}(7-6x) = 0$

$\cancel{e^{2x} = 0} \qquad 7-6x=0$

$7 = 6x$

$x = 7/6$

$$7/6$$

$+ \qquad\qquad -$

$$f'(0) = e^{2\cdot 0}(7-6\cdot 0) = +$$

$+ \qquad +$

$$f'(2) = e^{2\cdot 2}(7-6\cdot 2) = -$$

$+ \qquad -$

inc on $(-\infty, 7/6)$

dec on $(7/6, \infty)$

$$\frac{d}{dx}\left(e^{5x^2+7x}\right) = e^{5x^2+7x}\cdot(10x+7)$$

---

solve for x in $7^x = 52$

(write your answer in terms of ln's!)

$$7^x = 52$$

$$\ln 7^x = \ln 52$$

$$x\ln 7 = \ln 52$$

$$x = \frac{\ln 52}{\ln 7}$$

$$7^x = 3^{2x+5}$$ solv for x.

$$\ln 7^x = \ln 3^{2x+5}$$

$$x \ln 7 = (2x+5)\ln 3$$

$$x \ln 7 = 2x\ln 3 + 5\ln 3$$

$$x\ln 7 - 2x\ln 3 = 5\ln 3$$

$$x(\ln 7 - 2\ln 3) = 5\ln 3$$

$$x = \frac{5\ln 3}{\ln 7 - 2\ln 3}$$

Find any x where the slope is 5

for $f(x) = 3x^2 + 7x + 2$

(take deriv, set it $= 5$, solve for x)

$$f'(x) = 6x + 7$$

$$6x + 7 = 5$$

$$6x = -2$$

$$x = -2/6 = -1/3$$

$$f(x) = \frac{x^8 - 10x^2}{x^5} = (x^8 - 10x^2)\,x^{-5}$$

$$= x^3 - 10x^{-3}$$

$$f'(x) = 3x^2 + 30x^{-4}$$

$$8\log_7(3x^2-7x+\sqrt{x})$$

$x^{1/2}$

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

$$8\cdot\frac{1}{(3x^2-7x+\sqrt{x})\ln 7}\cdot\left(6x-7+\frac{1}{2}x^{-1/2}\right)$$

$\frac{d}{dx}\ln x = \frac{1}{x}$

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

$$\underbrace{8^{x^2}}\,\underbrace{\ln(x^4-4^x)}$$

$$8^{x^2}\cdot\frac{1}{x^4-4^x}\cdot(4x^3-4^x\ln 4)+\ln(x^4-4^x)\cdot$$

$8^{x^2}\ln 8\cdot 2x$

2^2x^2

$\downarrow$

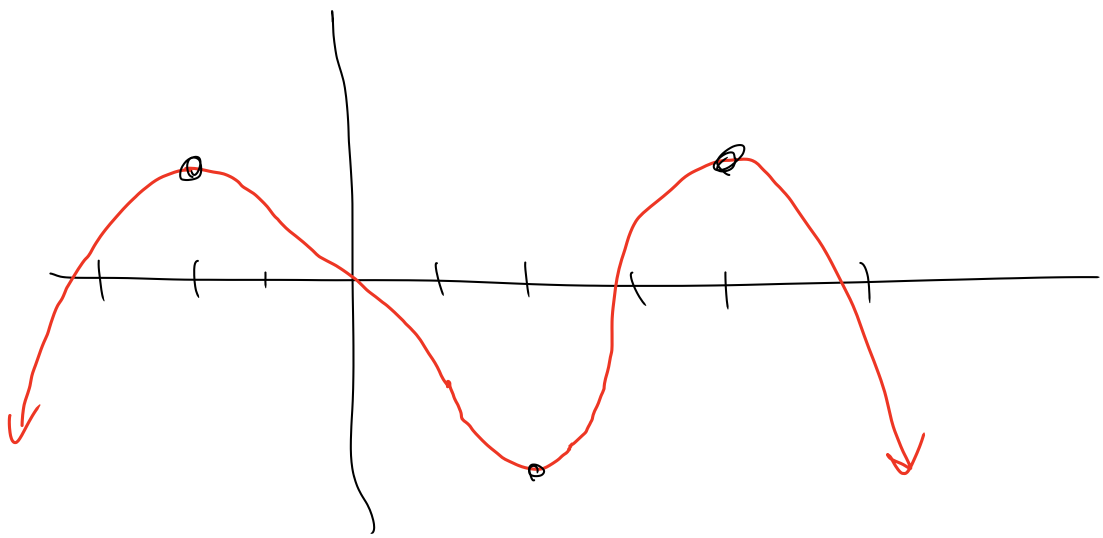
$\frac{d}{dx}\log_a x = \frac{1}{x\ln a}$

$$2^x+\log_2 x+\log 2x+(2x)^2$$

$\downarrow$

$$2^x\ln 2+\frac{1}{x\ln 2}+\frac{1}{2x\ln 10}\cdot 2+2(2x)^1\cdot 2$$

$2x^2 \to 4x$



give x values of relative extrema, say if it's max/min.

$x = -2$ is a rel max

$x = 2$ is a rel min

$x = 4$ is a rel max

intervals where it's inc/dec

inc on $(-\infty, -2)$ & $(2, 4)$

dec on $(-2, 2)$ & $(4, \infty)$