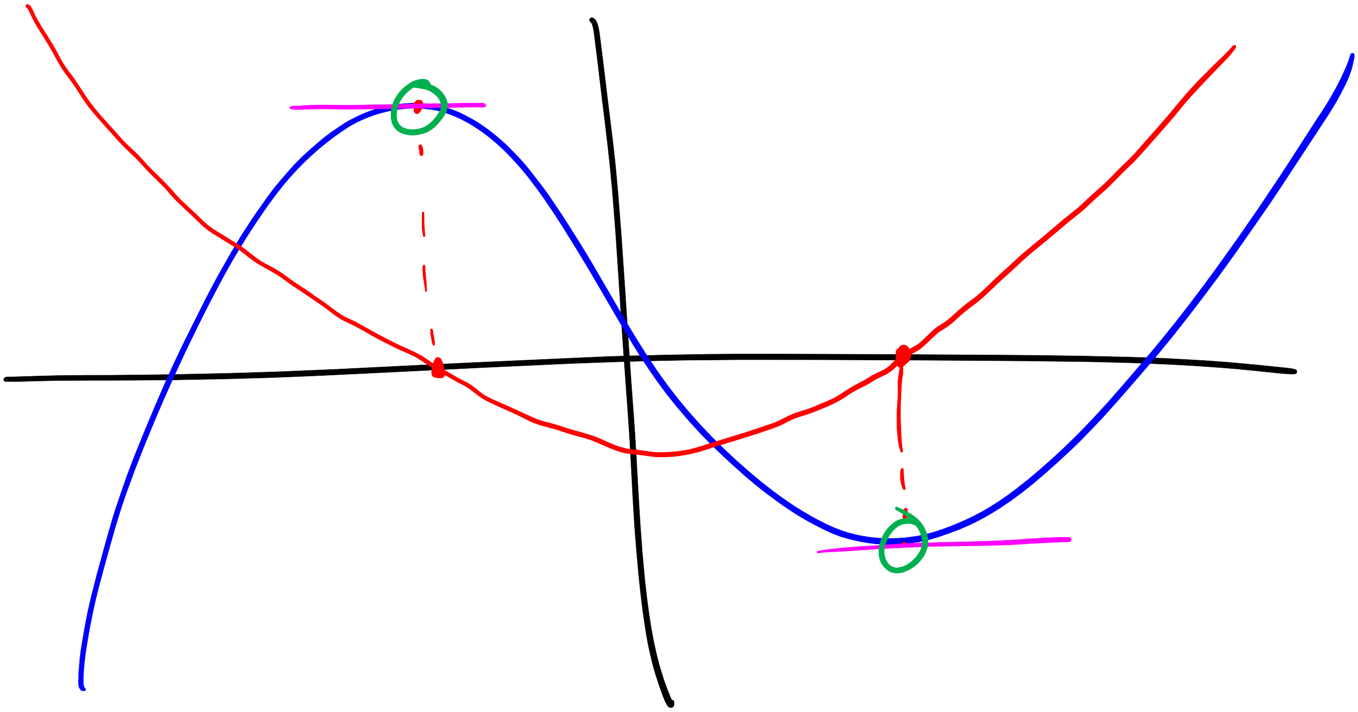
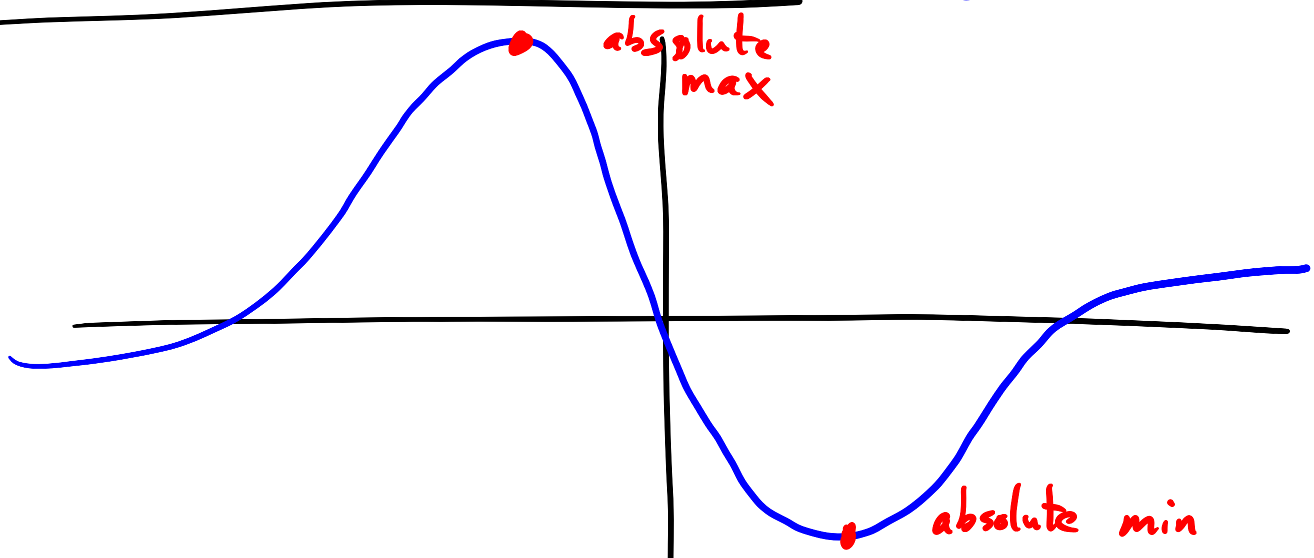


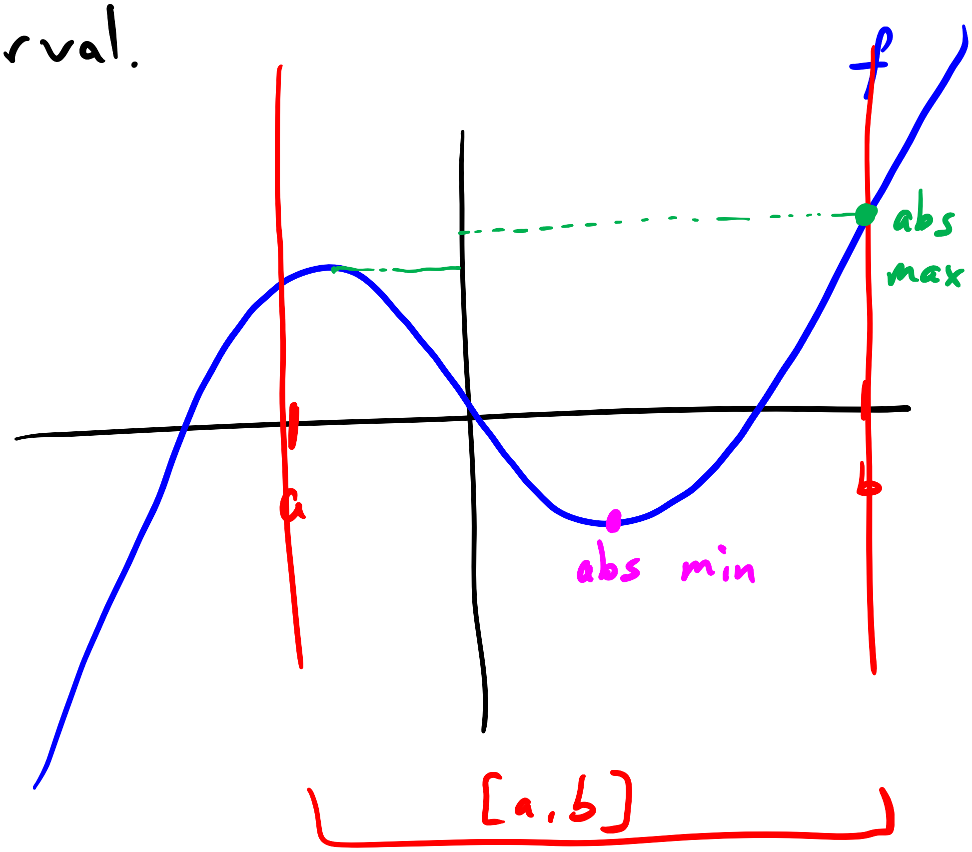
<u>Def</u>: Let f be defined on a set D containing c. If $f(c) \geq f(x)$ for every x in D, then $f(c)$ is an <u>absolute maximum value</u> of f on D. If $f(c) \leq f(x)$ for every x in D, then $f(c)$ is an <u>absolute minimum value</u> of f on D.

<u>absolute extreme values</u> $D = \mathbb{R}$

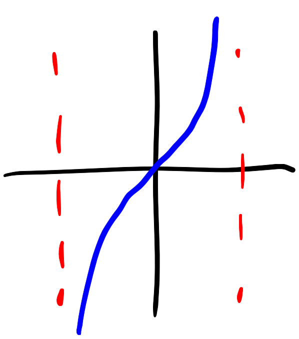


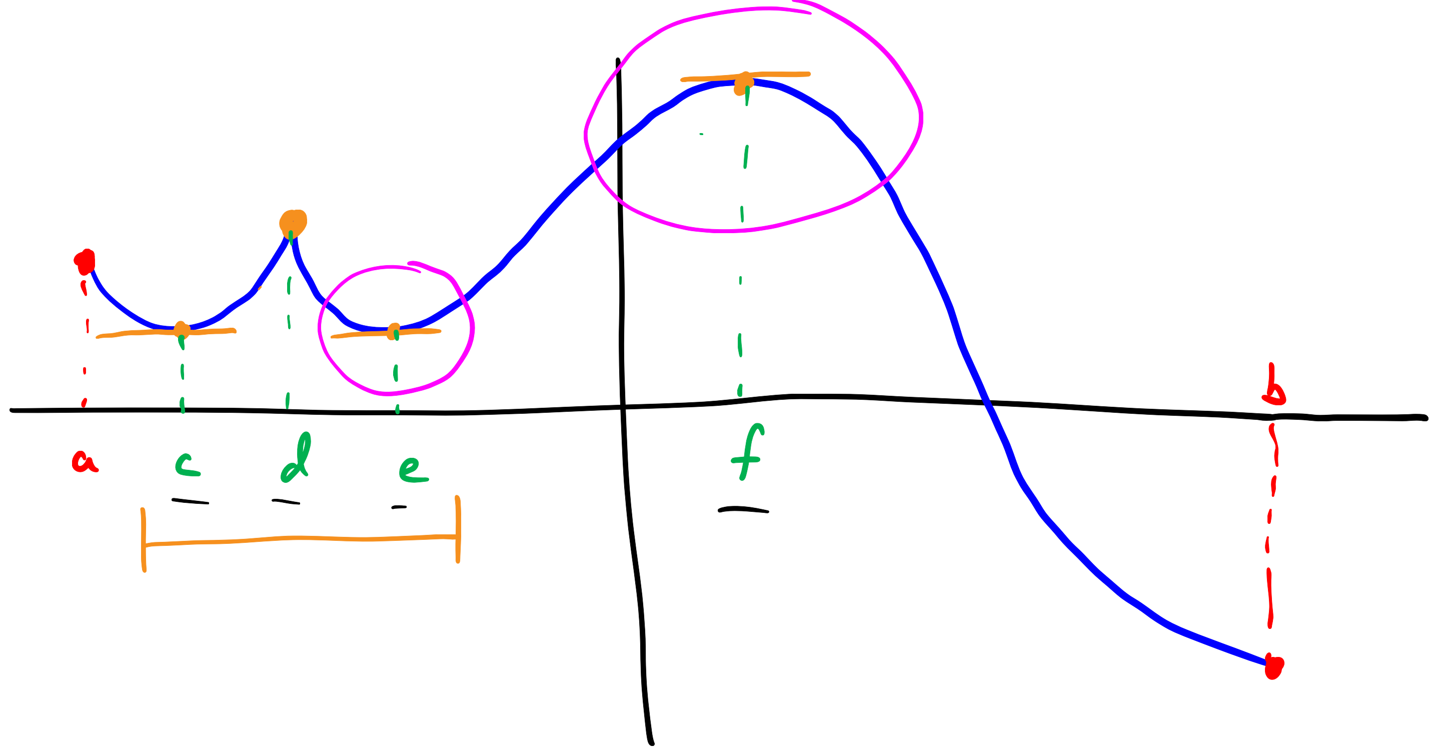
Extreme Value Theorem

A function that is continuous on a closed interval $[a,b]$ has an absolute maximum value and absolute minimum value on that interval.



on $\mathbb{R}$ $(-\infty, \infty)$, f has no absolute extrema





e, c - local minimum

d - local maximum

f - local maximum & absolute maximum

b - absolute minimum (not a local minimum)

Def (local extrema)

Suppose c is an interior point of <u>some</u> interval I on which f is defined. If $f(c) \geq f(x)$ for all x in I, then $f(c)$ is a <u>local maximum value</u> of f. If $f(c) \leq f(x)$ for all x in I, then $f(c)$ is a <u>local minimum value</u> of f.

Theorem: If f has a local minimum or maximum at c and $f'(c)$ exists, then $f'(c) = 0$.

Def: An interior point of the domain of f at which $f'(c) = 0$ or $f'(c)$ is undefined is called a <u>critical number</u> of f.

Ex: Find the critical numbers of

$$f(x) = x^2 \ln x$$

Sol: $f'(x) = 2x \ln x + x^2 \cdot \frac{1}{x} = 2x \ln x + x$

$$= \underbrace{x(2\ln x + 1) = 0}$$

$\hookrightarrow$ $x = 0$ or $2\ln x + 1 = 0$

$\hookrightarrow$ $\ln x = -\frac{1}{2}$

$\hookrightarrow$ $x = e^{-1/2}$

crit #

not a crit # b/c $x = 0$ is not in the domain of f.