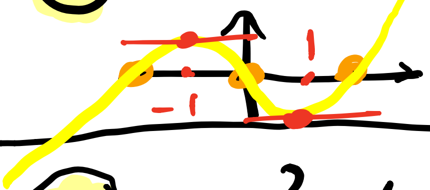
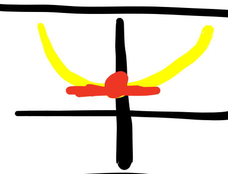
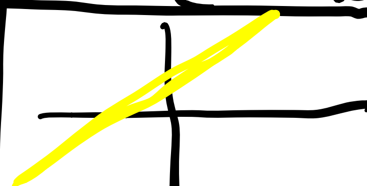
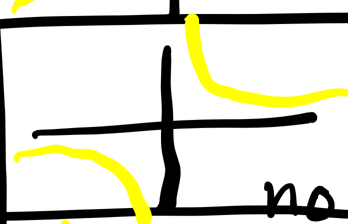
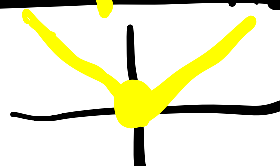
# Unit 11

Feb 22

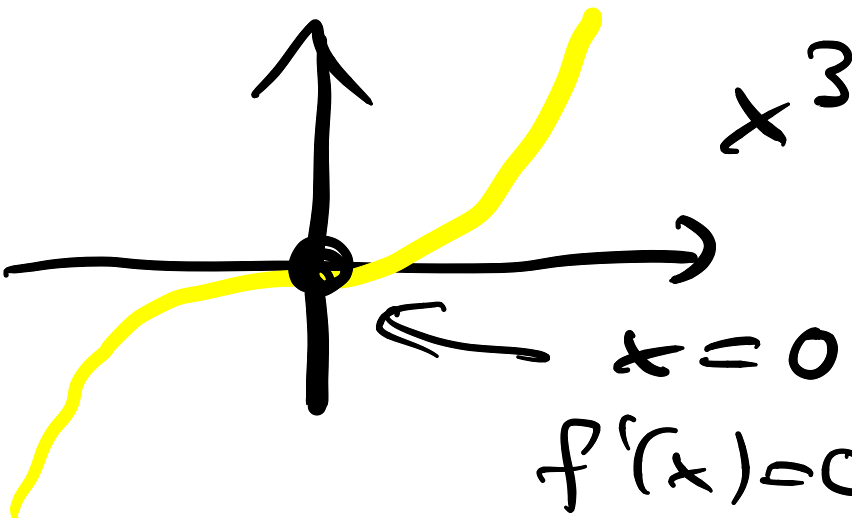
| | Crit. points |
|---|---|
| a) $x^3 - 3x$  | $x = -1, +1$ are critical point becau $f'(x) = 3x^2 - 3 = 0$ |
| b) $x^2 + 1$ | $x = 0$  |
| c) $e^x$ | there are none! $e^x$ has no root |
| d) $3x + 1$ |  no crit. poi |
| e) $\frac{1}{x}$ |  undefined at $x=0$ no crit. point |
| f) $\lvert x \rvert$ |  $f'$ is not defined at $x=0$ |

## Discussion!

What happens if $f'(x) = 0$, $f''(x) = 0$

inflection point

indicates max, min



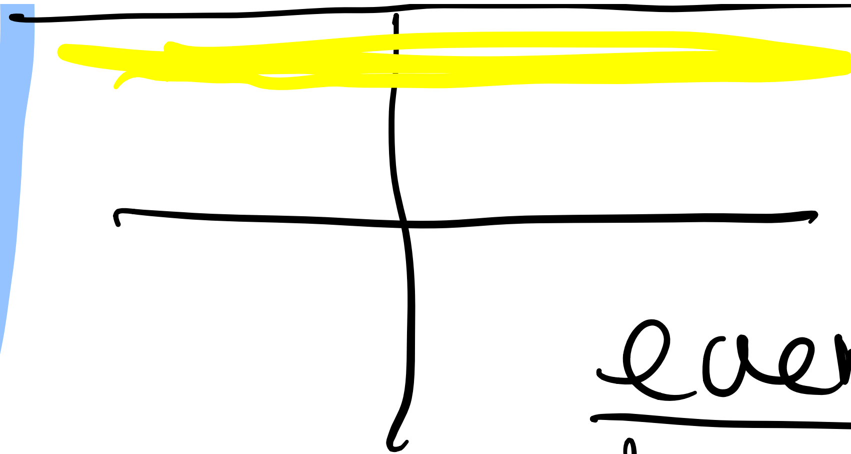

$f'(x)=0, f''(x)$

inflection point.

- Can we have a max or min if $f'(x)=0$ $f''(x)=0$.

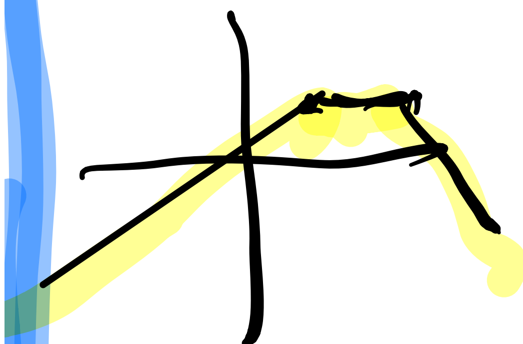
**Yes!**

Can we find examples?



$f = 1$

every point is critical and max and min

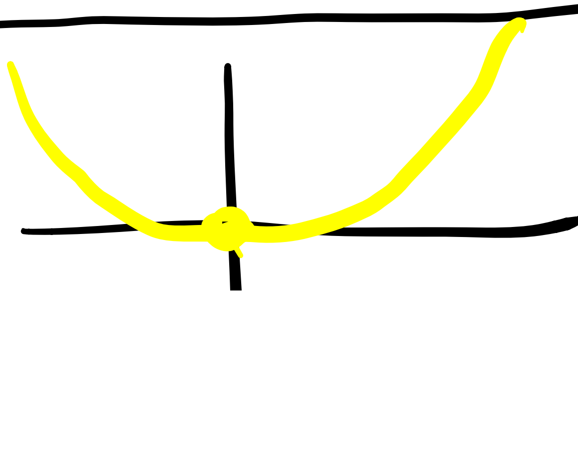


Can we find a non const polynomial?

$$\boxed{f(x) = x^4}$$

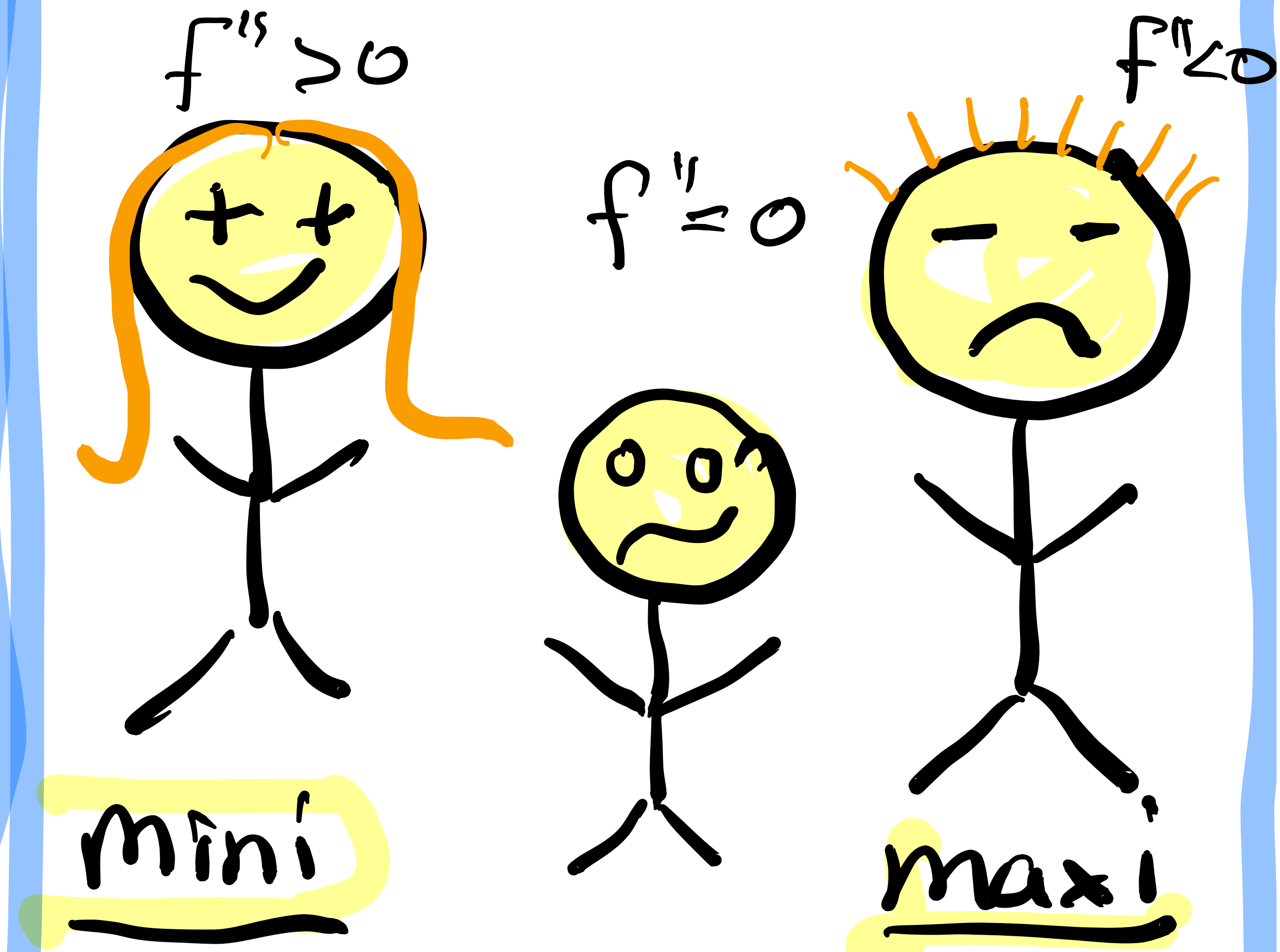
$f' = 4x^3$

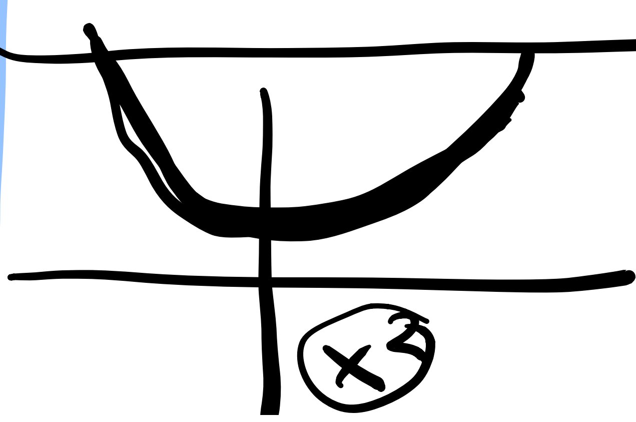
$f'' = 12x^2$



min at $x=0$

maximum! $f(x) = -x^4$

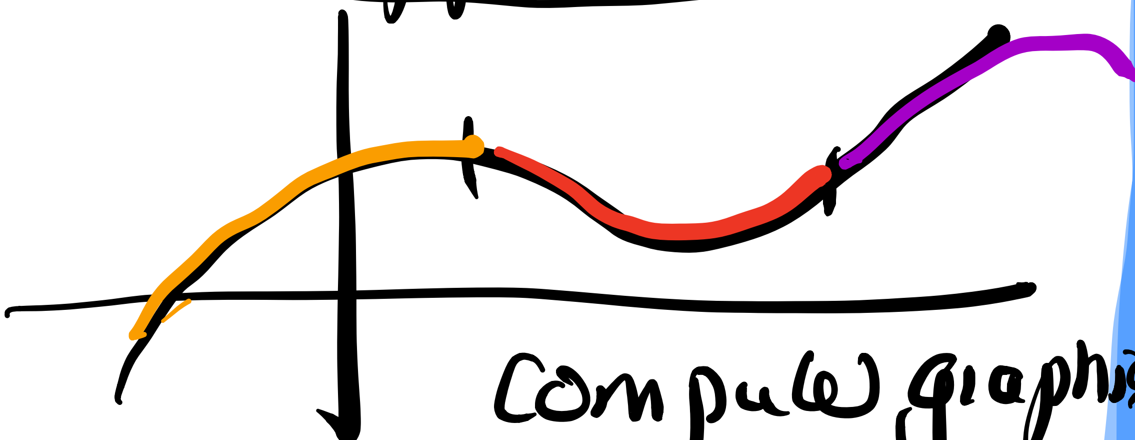



$f'' > 0$

f looks like a parabola

→ Approximation

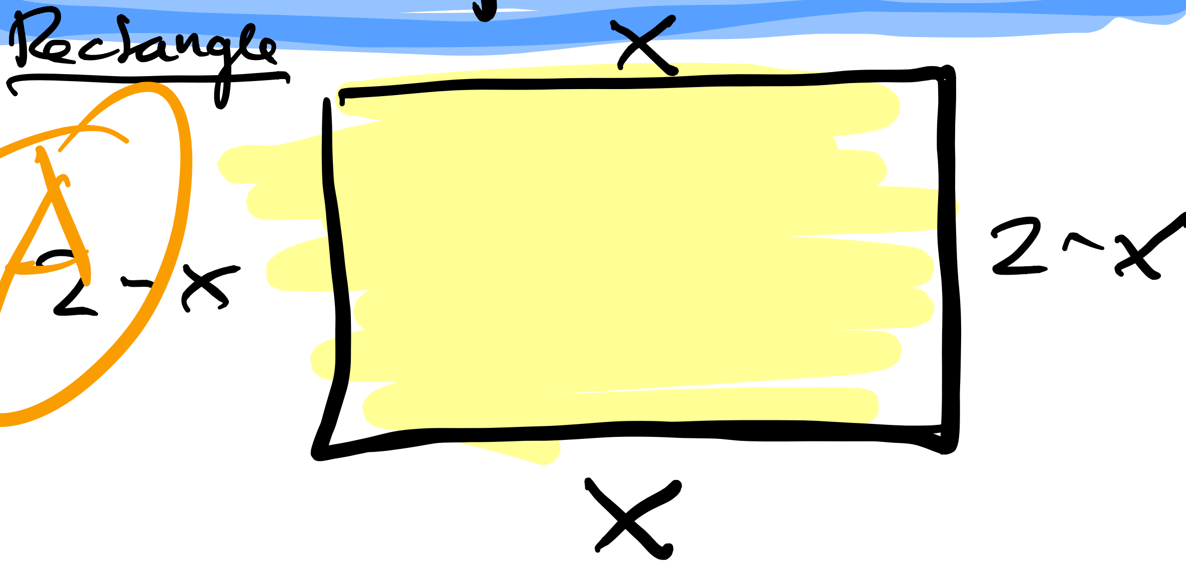


computer graphics

Splines

Rectangle

A




$$f(x) = (2-x)\cdot x$$

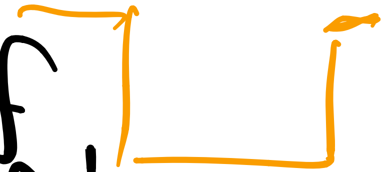
$$f'(x) = 2-2x = 0$$

$$x = 1$$

B

$\boxed{\text{Chicken problem}}$

$x(10-2x) = f$

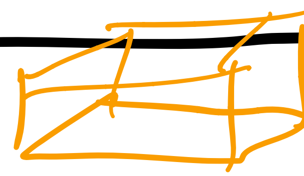


$10x - 2x^2 = f'$

$10 - 4x = 0$

C

$\boxed{\text{Tray problem}}$



$x \cdot (1-2x)^2 = f$