

# GLOBAL MAXIMA and MINIMA (4.3)

Optimization - Finding maximum and minimum values.

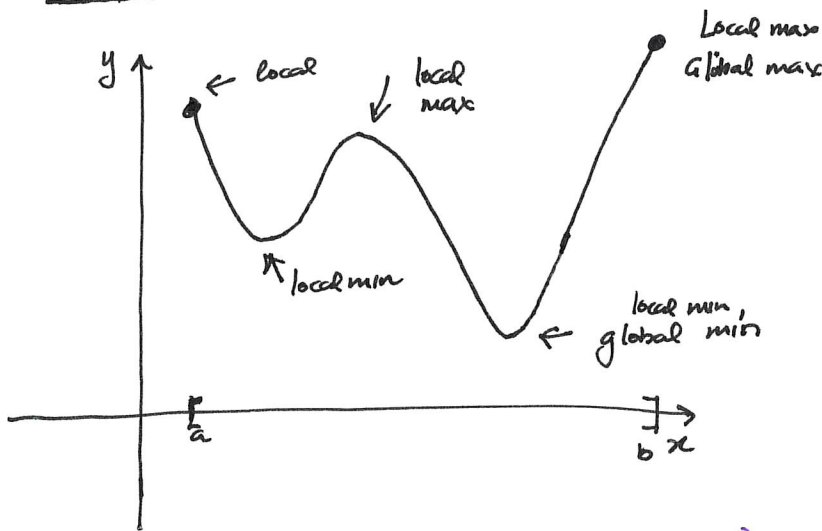
$f$  has a global minimum at  $p$  if  $f(p)$  is less than or equal to all values of  $f$

$f$  has a global maximum at  $p$  if  $f(p)$  is greater than or equal to all values of  $f$ .

Finding Global maxima/minima on a closed interval

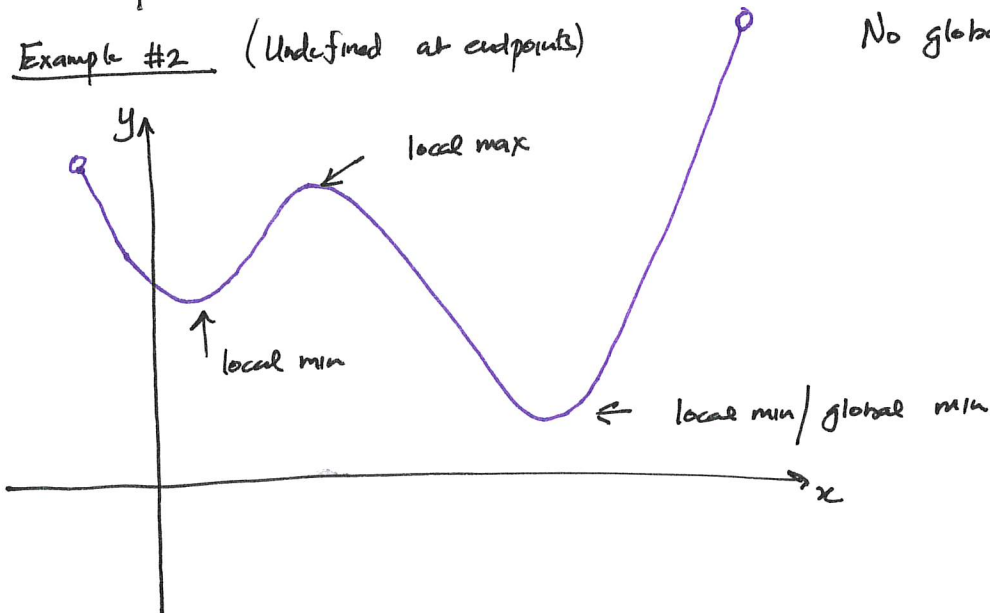
The extreme values will occur at the endpoints or critical points.

Example #1



\* The closed interval requirement is key!

Example #2 (Undefined at endpoints)



No global max

## Example

Find the global maxima/minima of  $x^3 - 3x^2$  on  $[-1, 3]$ .  
as in class example.

### Step 1

Find critical points

$$f'(x) = 3x^2 - 6x \Rightarrow \begin{array}{l} 3x^2 - 6x = 0 \\ x = 0, 2 \end{array}$$

We know that the global max/min occurs at either the endpoints or at critical points so we evaluate

$$f(-1) = (-1)^3 - 3(-1)^2 = -4$$

$$f(3) = 3^3 - 3 \cdot 3^2 = 27 - 27 = 0$$

$$f(0) = 0$$

$$f(2) = 2^3 - 3 \cdot 2^2 = 8 - 12 = -4.$$

