Lesson 18

Read 4.1

Global min and max on $[a, b]$

Terminology

Given a function $f(x)$

- an open interval is an interval of the form (a, b) (a and b are allowed to be ∞)
- a closed interval is an interval of the form $[a, b]$
- the domain of f consists of all allowed values of x.
- a local maximum is a number c (x value) that is in the domain of f, but , if the domain is a closed interval $[a, b]$, it is not a nor b, such that there is an open interval I containing c and contained in the domain of f s.t. for all x in I we have $f(c) \geq f(x)$.
- a local maximum value is a value $y = f(c)$ when c is a local maximum

- a local minimum is a number c (x value) that is in the domain of f, but , if the domain is a closed interval $[a, b]$, it is not a nor b, such that there is an open interval I containing c and contained in the domain of f s.t. for all x in I we have $f(c) \leq f(x)$.
- a local minimum value is a value $y = f(c)$ when c is a local minimum.
- A critical number is a number c in the domain of f , s.t. either $f^{'}(c) = 0$ or $f^{'}(c)$ does not exist

- a global or absolute maximum is a number c (x value) that is in the domain of f such that s.t. for all x in I we have $f(c) \geq f(x)$.
- the gobal or absolute maximum value is the value $y = f(c)$ when c is a global maximum.
- a global or absolute minimum is a number c (x value) that is in the domain of f such that s.t. for all x in I we have $f(c) \leq f(x)$.
- the gobal or absolute minimum value is the value $y = f(c)$ when c is a global minimum.

local max $=$	local max value $=$
global max $=$	global max value$=$
local min $=$	local min value $=$
global min $=$	global min value$=$
critical points $=$	

local max =	local max value =
global max =	global max value=
local min =	local min value =
global min =	global min value=
critical points =	

local max =	local max value =
global max =	global max value=
local min =	local min value =
global min =	global min value=
critical points =	

Important facts about local max and min

- All local min and max of a function are critical points for the function
- A function may have critical points that are neither local min nor max

Important facts about global max and min

- All global max and min of a function are either endpoints of the domain of the function or local max and local min respectively the function
- A continuous function defined on a closed and bounded interval $[a, b]$ always has a global max and a global min.
- If f is a continuous function defined on $[a, b]$ then the global max or global min are either a or b or critical number for f.

Global max and min calculations

To find the global max and min of a continuous function defined on a closed and bounded interval $[a, b]$

- Find all critical number of f
- Calculate all values of f at a, b and all critical points.
- The x value that gives the biggest f value in the computation above is the global max, the x value that gives the smallest f value in the computation below is the global min.

Find all critical points for $f(x) = \frac{x^3}{3} - \frac{5}{2}x^2 + 6x$

- Calculate $f^{'}(x)$
- Solve for $f^{'}(x) = 0$
- Find all values of x for which $f^{'}(x)$ is not defined.

Find the global min and the global max for $f(x) = \frac{x^3}{3} - \frac{5}{2}x^2 + 6x$ on $[0, 10]$

Find the global min and the global max for $f(x) = \frac{x^3}{3} - \frac{5}{2}x^2 + 6x$ on $[0, 1]$