

PM-Calculus

3.1 - Absolute & Local Extrema

The max and min values of a function are known as _____ or _____.

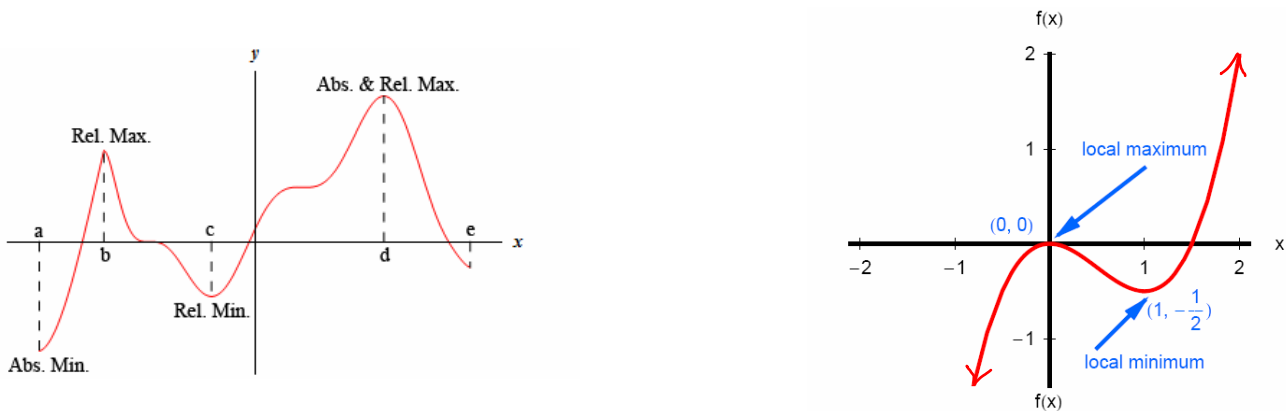
The process of finding **extrema** is called _____.

There are two types of extrema. Consider f defined over a closed interval $[a, b]$:

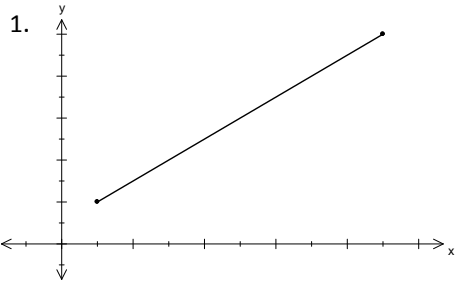
Absolute (Global) If $[a, b]$ contains c and $f(c) \geq f(x)$ for all x in $[a, b]$ then $f(c)$ is an **Absolute Max**.

Relative (Local) If c is **within** some _____ sub-interval of $[a, b]$ and $f(c)$ is the largest value in that open interval, then $f(c)$ is a **Local Max**.

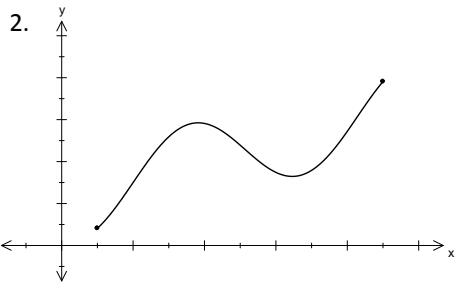
Does every function $f(x)$ have a max or min value?



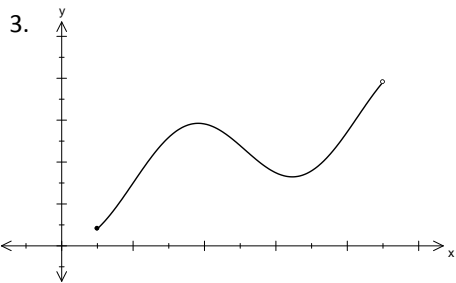
Finding Extreme Values Graphically.



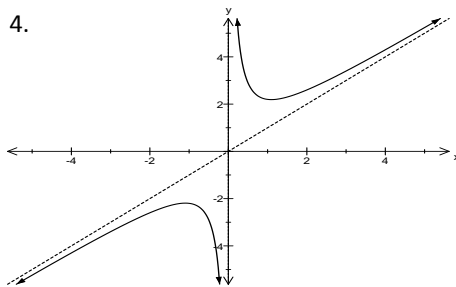
Absolute Max :
 Absolute Min :
 Local Max :
 Local Min :



Absolute Max :
 Absolute Min :
 Local Max :
 Local Min :



Absolute Max :
 Absolute Min :
 Local Max :
 Local Min :



Absolute Max :
 Absolute Min :
 Local Max :
 Local Min :

Finding Extreme Values Analytically.

Consider a continuous function f on a closed interval $[a,b]$.

The endpoints of a closed interval can only provide _____ max or min.

Local max or min can only occur in an _____ interval contained within $[a,b]$.

Local max or min occur when the graph looks like: _____ or _____ or _____

→ The **tangent line** at a **LOCAL** extremum either has slope: _____ or _____.

Critical Value A number c , in the domain of f , is a **critical value** if either i)
or ii)

→ **Fermat's Theorem** If $f(c)$ is a **LOCAL** extremum then _____.

→ To find all extrema of f : i) Find $f'(x)$

ii) Find **Critical Value(s)** → Find all x where $f'(x)=0$ or $f'(x)=\text{undefined}$

iii) Find value of $f(x)$ at each critical value and compare.

Examples

1. Find the critical values of $f(x) = x^3 - 9x^2 + 24x - 10$.

2. Find all extrema of $f(x) = 2x^3 - 15x^2 + 24x + 7$ on $[0, 6]$.

3. Find all extreme values of $f(x) = x^2 - 8\ln x$ on $[1, 4]$.