3.2 Extreme Values

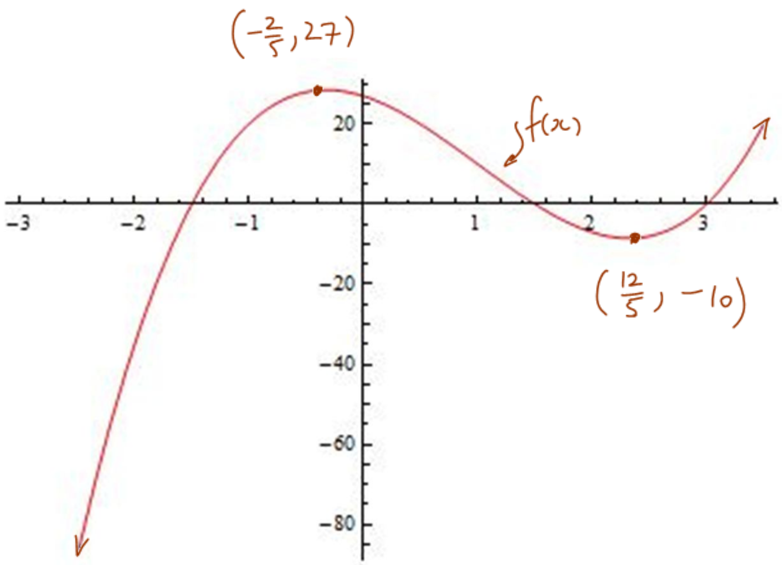
The **Maximum** or **Minimum** values which some function may have are called **Extreme Values**.

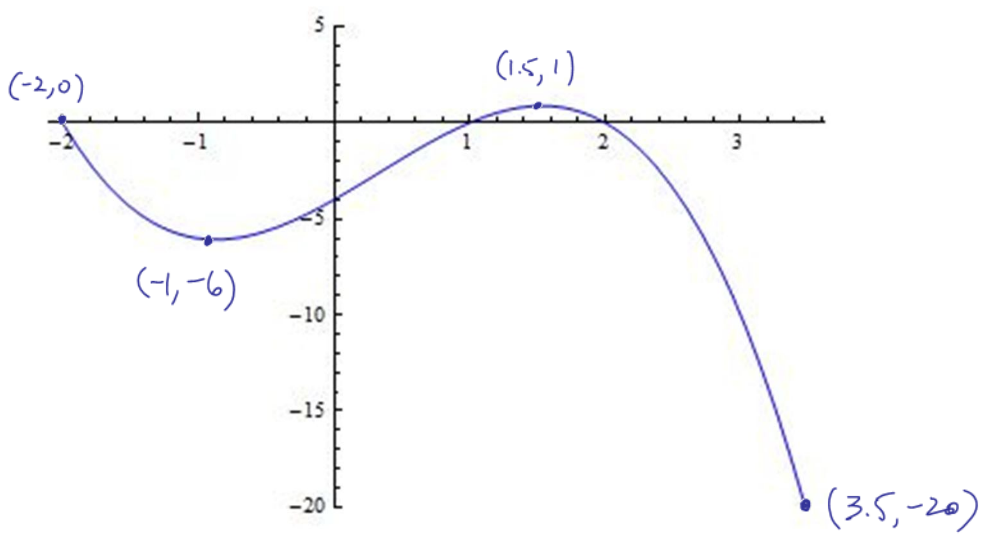
Definition 3.2.1

If a differentiable function, $f(x)$, has a **local extremum** at a domain value $x=c$, then

$$f'(c)=0$$

Pictures





Definition 3.2.2

Given a differentiable function, $f(x)$, we call any point $(c, f(c))$ a **critical point** of $f(x)$ whenever $f'(c)=0$

The Extreme Value Theorem

Given a differentiable function, $f(x)$, defined on a **closed interval** $x \in [a,b]$, **then**

$f(x)$ is **guaranteed** an **absolute/global maximum**, and an **absolute/global minimum**.

These **absolute extrema** occur at the endpoints of the interval, or at points $(c, f(c))$, inside the interval, where $a < c < b$, and where $f'(c)=0$.

(*No Proof given*)

The Algorithm for Finding Absolute/Global Extreme Values

> Note: *In this explanation we assume that the functions we are working with are differentiable on the given closed interval.*

1) Differentiate $f(x)$ (defined on the closed interval $x \in [a,b]$), and find all domain values $x = c$ $(c \in (a,b))$ where $f'(c)=0$. Such **domain values** are called **critical values**.

2) Test all critical values, $x = c$, and the domain values of the endpoints, $x = a$, and $x = b$, in the function $f(x)$ to calculate the absolute/global max and min values.

Example 3.2.1

Determine the absolute extrema of:

1) $f(x)=\dfrac{1}{x}$ on $x \in [-1,2]$

2) $g(x)=x^3-3x^2-9x+2$ on $x \in [-2,2]$

Class/Homework for Section 3.2

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