f has an **absolute maximum** (=**global maximum**) at c if $f(c) \geq f(x)$ for all x in domain of f.
$f(c)$ is the **maximum value** of f.

f has an **absolute minimum** (=**global minimum**) at d if $f(d) \leq f(x)$ for all x in domain of f.
$f(d)$ is the **minimum value** of f.

$f(c)$ and $f(d)$ are the extreme values of f.

f has a **local maximum** at c if $f(c) \geq f(x)$ for all x near c.

f has a **local minimum** at d if $f(d) \leq f(x)$ for all x near c.

Ex 1:

Ex 2: $f(x) = 3$

c is a **critical point** of f if $f'(c) = 0$ or if $f'(c)$ DNE.

If a local max or local min occurs at c, then c is a critical point of f (Note this is not an iff. I.e., the converse is not true).

Extreme Value Thm: If f continuous on $[a, b]$, then f has an absolute maximum, $f(c)$, and an absolute minimum, $f(d)$, for some $c, d \in [a, b]$.

Extreme values must occur either at critical values ($f'(x) = 0$ or DNE) or at endpoints.

Ex: Let $f(x) = x^3$. Find absolute minimum/maximum on the interval [-2,3].

Ex: Let $f(x) = x^3$. Find absolute minimum/maximum on the interval (-2,3) (if they exist).

Ex: Let $f(x) = \begin{cases} \frac{1}{x} & x \neq 0 \\ 0 & 0 \end{cases}$. Find absolute minimum/maximum on the interval [-2,3] (if they exist).

Ex: Let $f(x) = (x-2)^{\frac{2}{3}}$. Find absolute minimum/maximum on the interval [1,5].

Ex: Let $g(x) = x^3+3x^2+1$. Find absolute minimum/maximum on the interval [-3,1].

Fermat's Thm: If a local max or local min occurs at c, then c is a critical point of f.

Proof: