1 5.2: Maxima and Minima

Definitions:

f has a **relative maximum at** $x = a$ if and only if

f has a **relative minimum at** $x = a$ if and only if

Fermat's Theorem: If f has a relative maximum or relative minimum at $x = a$ and f is differentiable at $x = a$, then

More Definitions:

f has a **critical value** at $x = a$ if and only if

f has an **absolute maximum** at $x = a$ if and only if

f has an **absolute minimum** at $x = a$ if and only if

Extreme Value Theorem If f is continuous on a closed, bounded interval, then

Graphical examples to show that each of the conditions must hold to guarantee the conclusion:

Examples:

Find the absolute maximum and absolute minimum of $f(x) = \dfrac{\ln x}{x^2}$ on the interval $(0, 3)$.

A metal pipe 120cm long is to be cut and used to make a rectangular-shaped "U bar" to be attached to a wall (see figure below). What dimensions will maximize the area enclosed by the U-bar? (Ignore the size of connecting pieces)

On Your Own:

Find the absolute maximum and absolute minimum of $f(x) = 4x^3 - 15x^2 + 12x + 7$ on the interval $0 \leq x \leq 3$.

minimum = 3; maximum = 16