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 \( f(x) = 2x^3 - 15x^2 + 36x + 7 \) on the interval \([1, 5]\).

Find the absolute maximum and absolute minimum of \( f(x) = 2\sec x - \tan x \) on the interval \([0, \frac{\pi}{4}]\).
Find the absolute maximum and absolute minimum of \( f(x) = \frac{\ln x}{x} \) on the interval \((0, \infty)\).

Find the dimensions of a rectangle with perimeter 100 m whose area is as large as possible.

On Your Own: 5.2 #3,7,10,25,27,30,34,35,36,38,42,43,46,52; 5.5 #1,5,20,25,26,50