2.5 Solving Problems involving Rates of Change

"I know...

- what global (absolute) maximums and minimums, and I can identify them on a graph;
- what local maximums and minimums, and I can identify them on a graph;
- how use the algebraically simplified difference quotient to determine the presence of a local minimum and local maximum.

Recall: The calculations for rate of change at $x = a$ and slope of the tangent at $x = a$ are identical.

Local Maximum at $x = c$

Given $y = f(x)$. For values of x near c ... A **local maximum** at $x = c$ exists if the function's rate of change changes from positive to negative through $x = c$. At $x = c$ the rate of change will be zero (or undefined).

Local Minimum at $x = c$

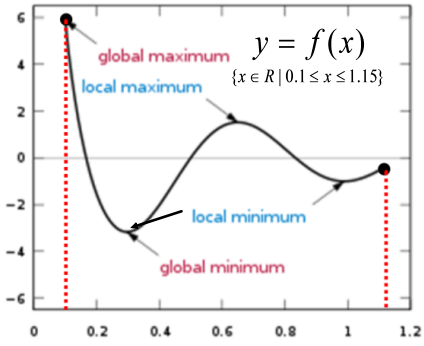
Given $y = f(x)$. For values of x near c ... A **local minimum** at $x = c$ exists if the function's rate of change changes from negative to positive through $x = c$. At $x = c$ the rate of change will be zero (or undefined).

Global Maximum at $x = c$

Given $y = f(x)$. A **global (absolute) maximum** at $x = c$ exists if $f(c) > f(x)$ for all values of x in the function's domain.

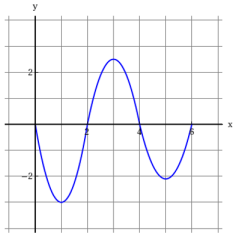
Global Minimum at $x = c$

Given $y = f(x)$. A **global (absolute) minimum** at $x = c$ exists if $f(c) < f(x)$ for all values of x in the function's domain.



Activity
With a partner...

Given a function $y = f(x)$ defined on $0 \le x \le 6$:



For this function's domain, state the integer(s) x that correspond to a…

Local minimum	Local maximum	Global minimum	Global maximum

Recall:

average rate of change

Given: $y = f(x)$. The average rate of change is calculated by:

$$\frac{\Delta y}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

difference quotient

When one uses the average rate of change (difference quotient) carefully, one can estimate the rate of change.

Example Using the *algebraically simplified* difference quotient, prove that a local minimum value occurs at $x = 3$ for $f(x) = x^2 - 6x + 5$

USE THE *ALGEBRAICALLY SIMPLIFIED DIFFERENCE QUOTIENT* FOR ALL RATE OF CHANGE CALCULATIONS:

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Careful! x is not 1500