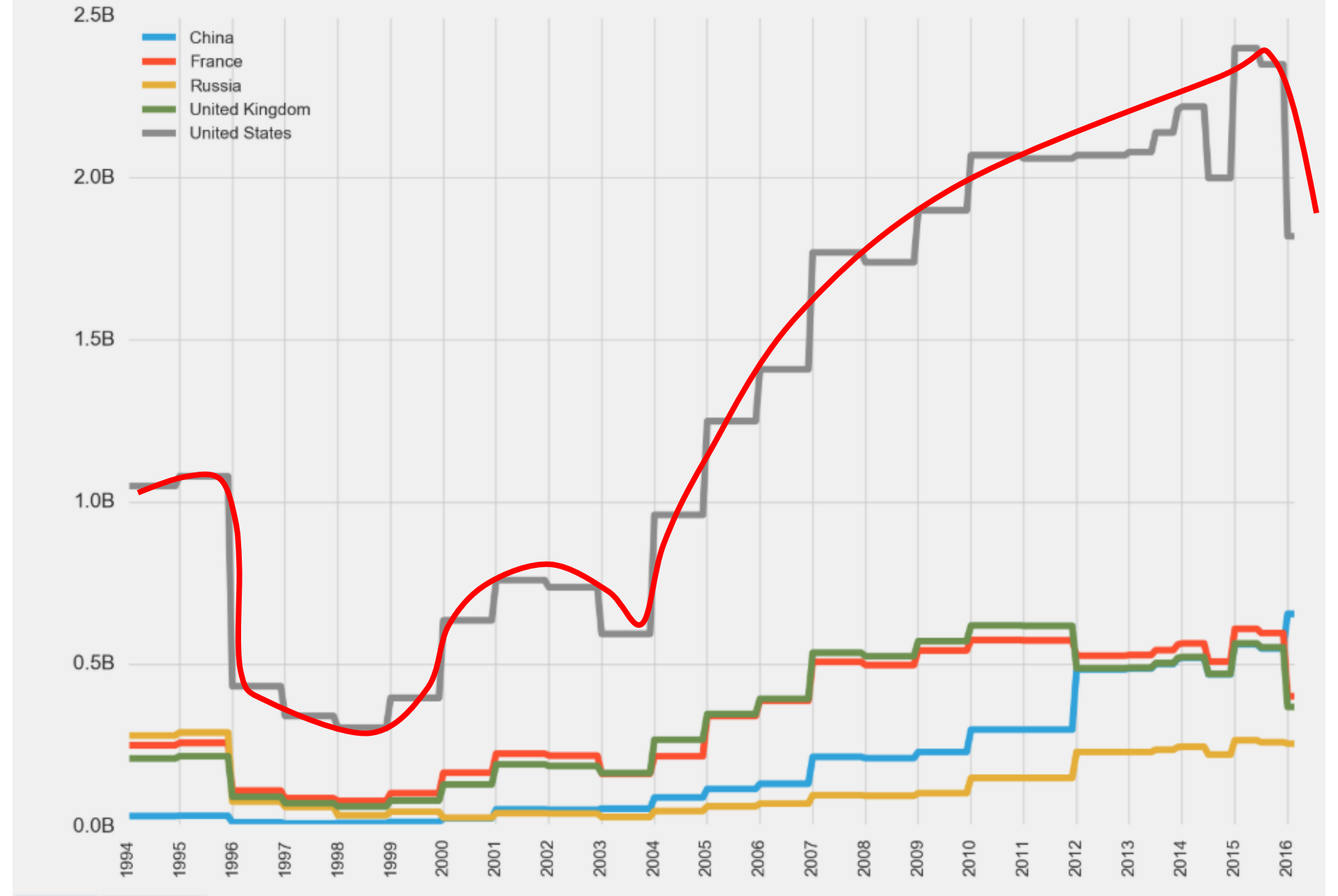
Math-2A
Lesson 6-3
Analyzing the Graphs of Functions
(Where is it increasing or decreasing?)

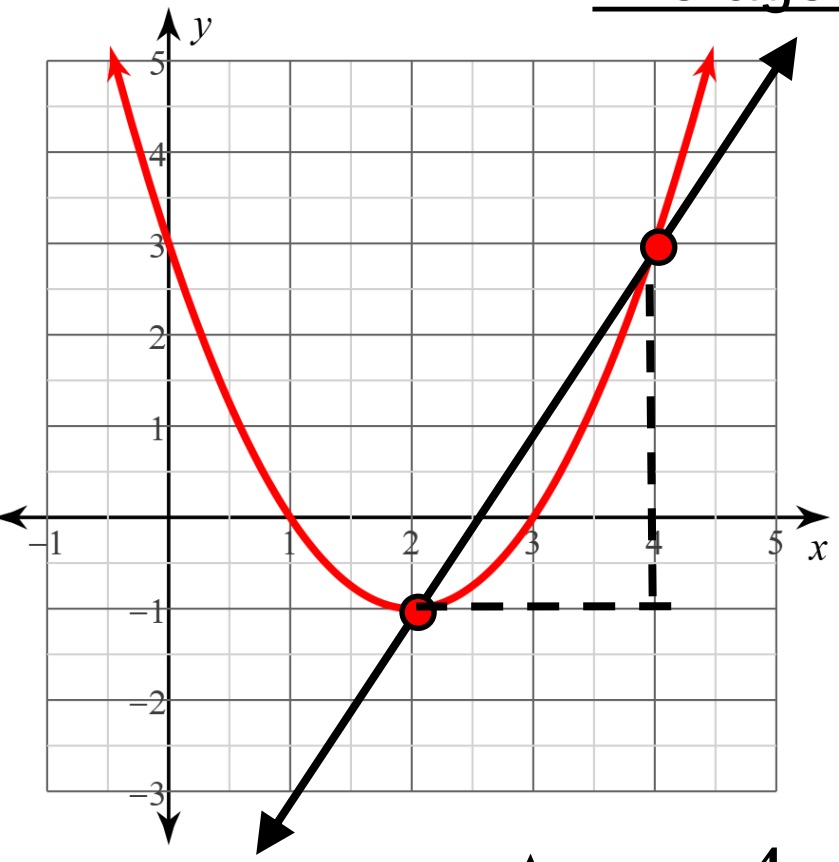
United Nations Peacekeeping Financial Contributions by the P5 (nominal $USD)

January 1994 - March 2016

PROVIDING FOR PEACEKEEPING



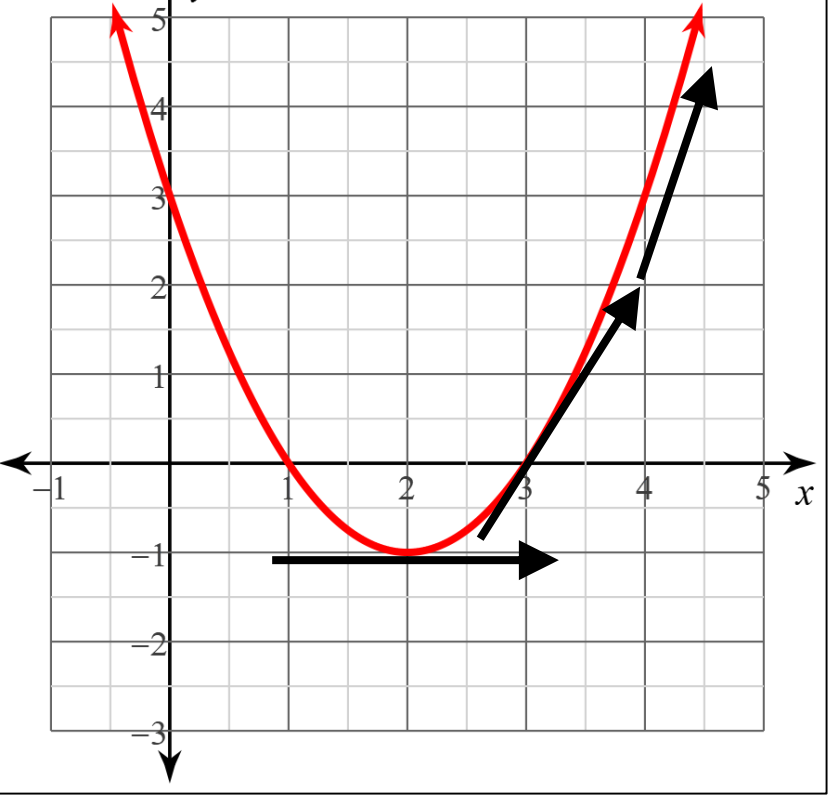
Average Rate of Change



What is the "average rate of change" between x = 2 and 4?

Means "what is the slope of the graph between the two points $(2, y_1)$ and $(4, y_2)$?

$$slope = m = \frac{\Delta y}{\Delta x} = \frac{4}{2} = 2$$



The Function is Increasing

→ if you draw a tangent line at a point on the graph and it has a positive slope, the function is increasing at that point.

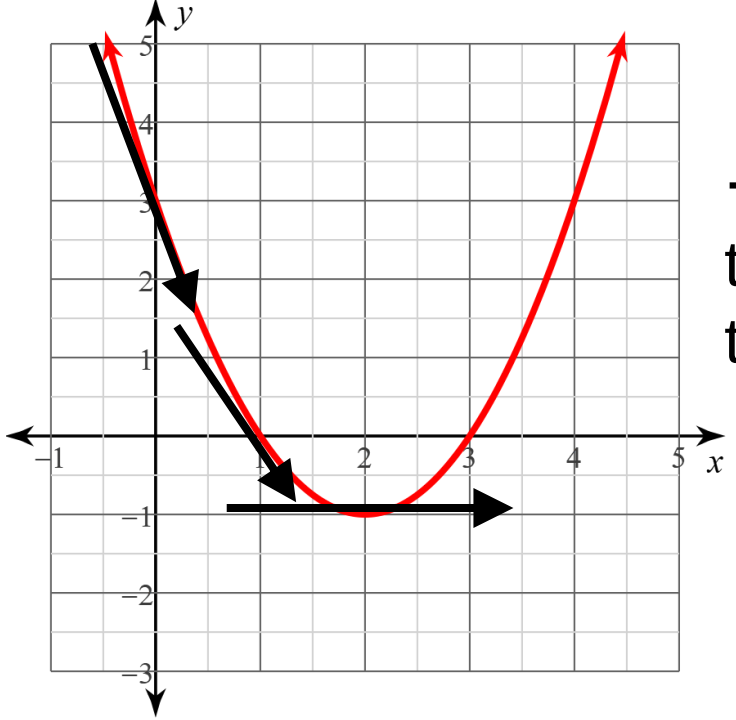
The slope of a tangent line at any point on the graph for the interval x = (2, ∞) is positive.

What about when x = 2?

The slope of a tangent line at x = 2 is zero (not increasing at that point).

We say: "the function is increasing on the (x) interval: **(2, ∞)**

$$f(x) \uparrow on\ x = (2, \infty)$$



The function is decreasing

→if you draw a tangent line at a point on the graph, and it has a negative slope, the function is decreasing at that point.

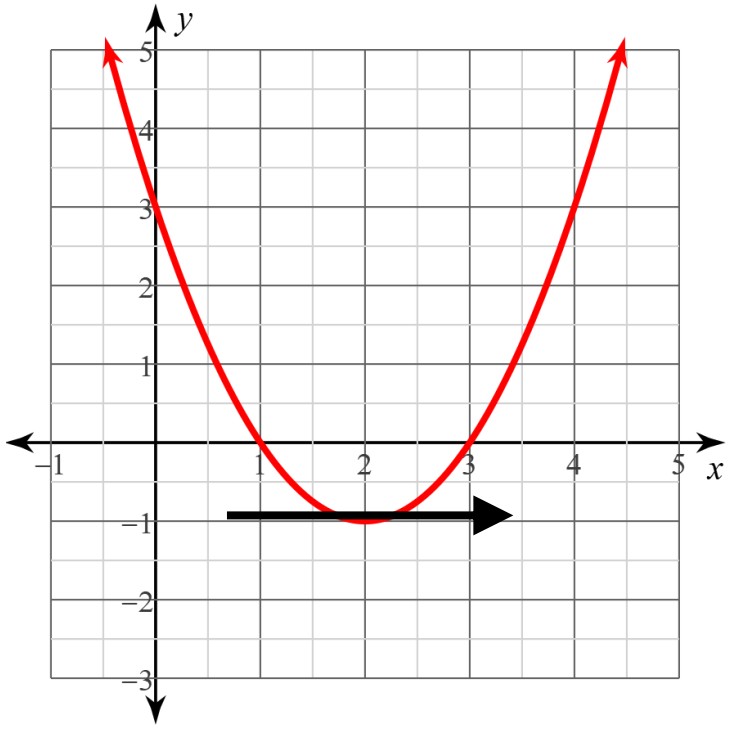
The slope of a tangent line at any point on the graph for the interval x = (-∞, 2) is negative.

What about when x = 2?

The slope of a tangent line at x = 2 is zero (not decreasing at that point).

We say the function is decreasing on the interval $x = (-\infty, 2)$

$$f(x) \downarrow on\ x = (-\infty, 2)$$



"Extrema"

Extrema: a point on a graph whose tangent line has a slope of zero.

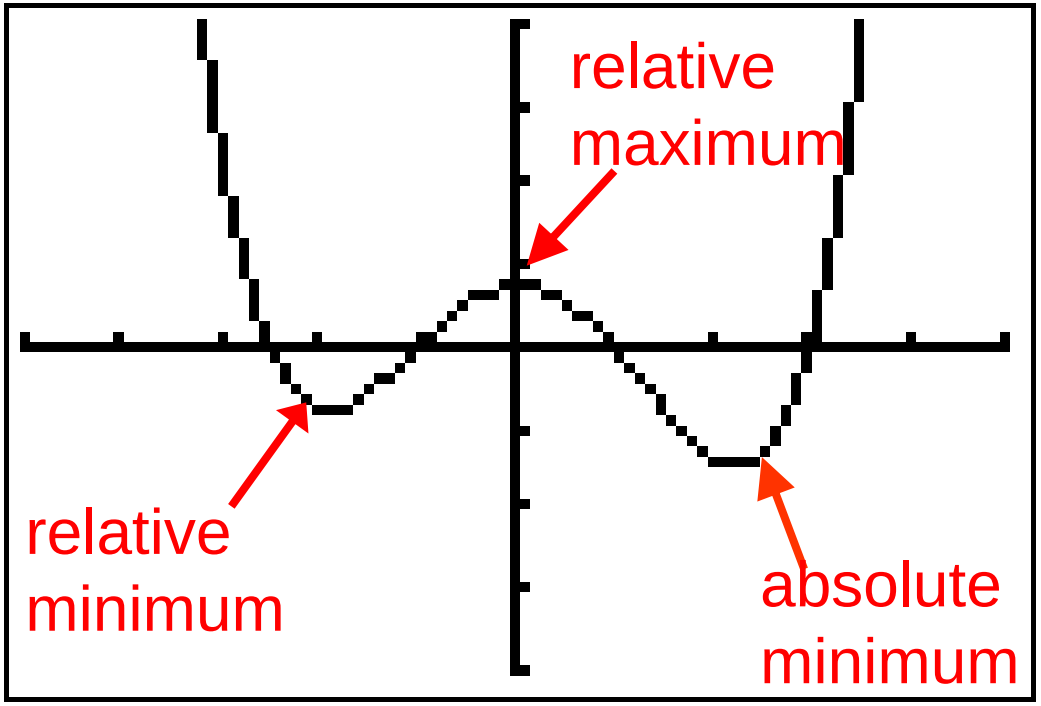
Does the graph have any extrema?

Yes. The slope of a tangent line at (2, 0) is zero (slope changes from negative to positive at x = 2).

You can think of extrema an points on the graph that are "peaks" or "valleys".

Extrema: the y-value of points that are extrema are either
(1) the maximum or minimum y-value on the graph, OR
(2) compared the points adjacent to them, are either the maximum or minimum y-value.

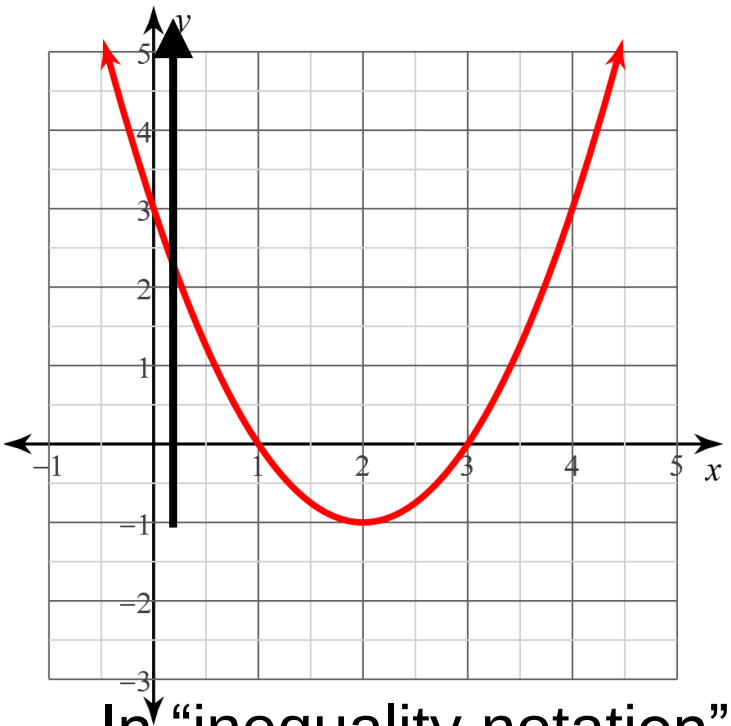
Extrema: a point on a graph whose tangent line has a zero slope.



We classify extrema by their y-values.

Absolute minimum (maximum): an extrema whose y-value is the smallest (largest) y-value for the entire function.

relative maximum (minimum): an extrema whose y-value is the greater than (less than) the y-value of points near it.



What is the "range" of the graph?

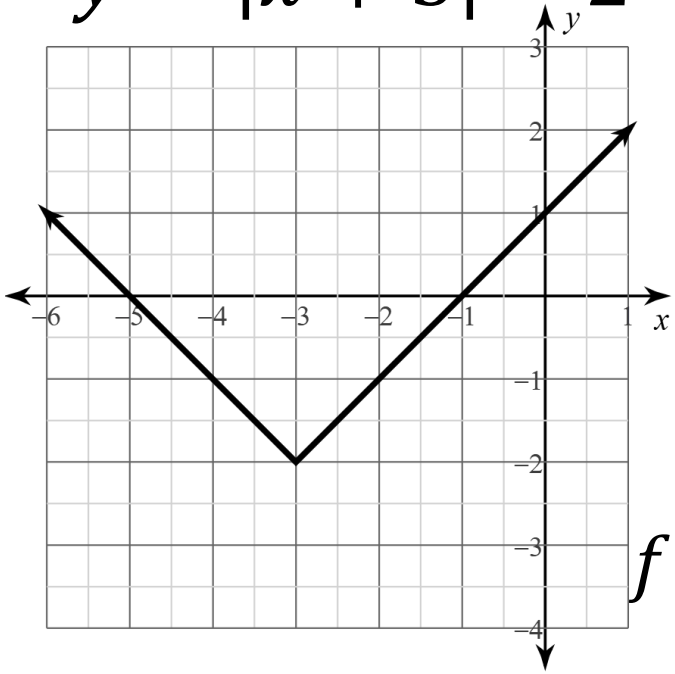
Means "what values of "y" are found in the graph?"

The smallest y-value of this graph is zero, and it goes upward from there.

In "inequality notation" we say the range is: $y \geq 0$

In "interval notation" we say the range is: $y = [0, \infty)$

$$y = |x + 3| - 2$$



1. Where is the function increasing?

$$f(x) \uparrow on\ x = (-3, \infty)$$

2. Where is the function decreasing?

$$f(x) \downarrow on\ x = (-\infty, -3)$$

3. Where is the function positive?

$$f(x) > 0\ for\ x = (-\infty, -3] \cup [6, \infty)$$

4. What are the "extrema"?

Absolute Minimum at (-3, -4)

5. What are the range?

$$Range\ of\ f(x): y = [-2, \infty)$$