9.2 Instantaneous Rate of Change – The IROC (part 1)

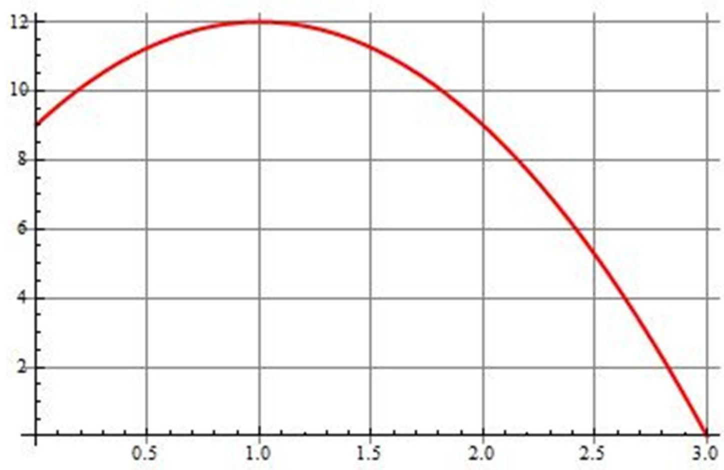
Last day we learned that for some given function $f(x)$ we can **calculate** the AROC of that function (over some interval of the domain) as the **slope of a secant**.

Example 9.2.1

Given the displacement function $s(t) = -3(t-1)^2 + 12$, determine the AROC of a water-balloon tossed from a 3rd floor balcony, over the (time) intervals:

a) $t \in [0,1]$ b) $t \in [1,3]$ c) $t \in [0,2]$

A Picture

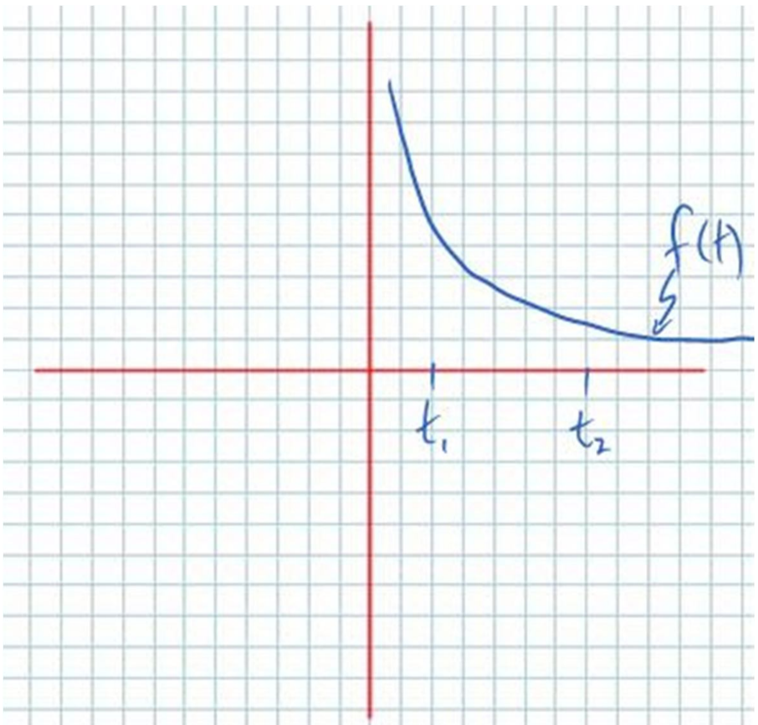


Note: Each AROC is a number which represents

Consider the question:

How can we calculate the velocity of the balloon at the **instant** $t = 2$ seconds?
Note: We CANNOT use the slope of a secant, since the secant requires two domain values, but an "instant" is at a single domain value $(t = 2 \text{ in this case})$.

Consider the following:



The **AROC** is the **slope** of a secant.

Geometrically speaking, the **IROC** is also a **slope**, but it's the slope of a **TANGENT**

The Problem is this:

We will consider two techniques for **ESTIMATING** the so-called

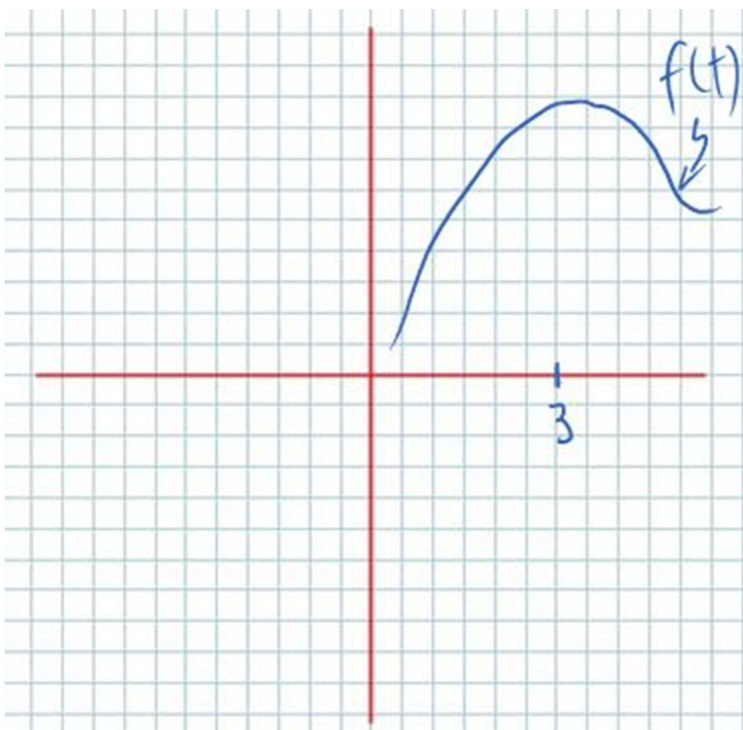
INSTANTANEOUS RATE OF CHANGE (IROC)

Note: To estimate the IROC (a number we CAN'T calculate) we will be calculating the slopes of secants because we can do that calculation!

1) Using a "**centered interval**" and **squeezing the interval** to get better and better **estimates**

A Geometric View

Consider the picture:



An Algebraic View

Example 9.2.2

Estimate the IROC for $s(t) = -2(t-1)^3 + 3$ at $t = 2$.

Example 9.2.3

From your text: Pg. 87 #5

Using a centered interval approach, determine an estimate for the IROC at $x = 3\sec$ of the height (in *m*) of an object, which is moving according to $h(x) = -5x^2 + 3x + 65$.

Class/Homework for Section 9.2

Pg. 86 – 87 #4ac, 6, 8, 9, 10 (centered interval only)