Unit One Notes

IROC vs AROC

Average Rate of Change (AROC) is the rate of change between two points. It is most accurate with linear functions, as the AROC does not mean a whole lot on a curve.

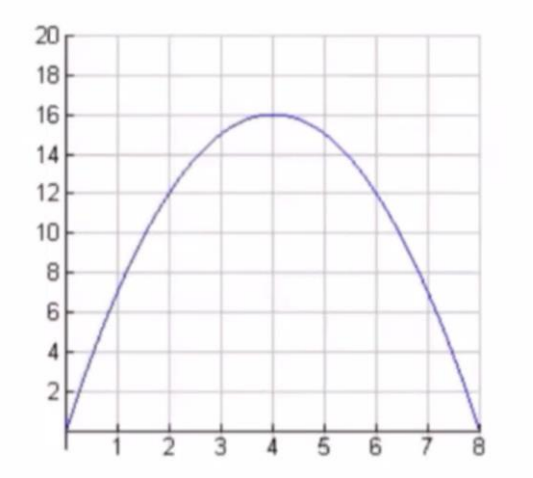
Calculus focuses on situations with variable rates, meaning that one would need the Instantaneous Rate of Change (IROC). This rate varies from point to point, as it is one maintained for an instant.

A particle's position h (in feet), at time t (in seconds) is represented by the function:

$$H(t) = -t^2 + 8t$$

What is the average velocity (rate of change) of the particle during the first two seconds?

What about from t = 2 to t = 4?



t = 0 to t = 2 → AROC of 6

t = 2 to t = 4 → AROC of 2

The AROC of a curve uses secant lines.

What is the instantaneous velocity of t = 2?

Trying to find the AROC does not work, as the formula will return 0/0.

To find the rate of change of a single point, we have got to decrease the interval continuously.

t	h	*Average Rate of Change
T = 0 T = 2	H = 0 H = 12	6 ft/s
T = 1 T = 2	H = 7 H = 12	5 ft/s
T = 2 T = 2.1	H = 12 H = 12.39	3.9 ft/s
T = 2 T = 2.01	H = 12 H = 12.0399	3.99 ft/s
T = 2 T = 2.001	H = 12 H = 12.003999	3.999 ft/s

*Note that the Average Rate of Change formula is AROC = $(h_2 - h_1)/(t_2 - t_1)$.

As the time interval decreases, the AROC approaches 4 ft/s, though it will never equal *exactly* 4 ft/s. Therefore, it is correct to say that the instantaneous velocity at t = 2 is 4 ft/s.

In Summary:

Average Rate of Change is the amount of change per the time it took for the change to occur while the **Instantaneous Rate of Change** is the limit of the average rates of change over a small interval.