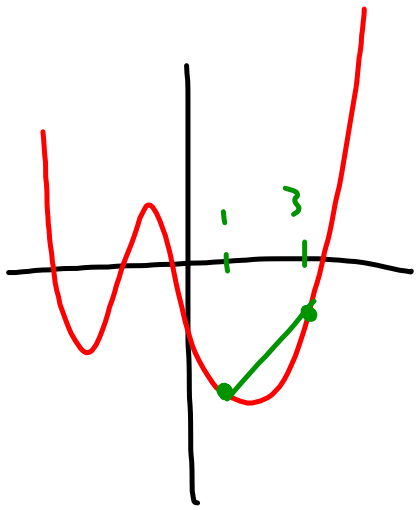
Rate of Change

Average rate of change:

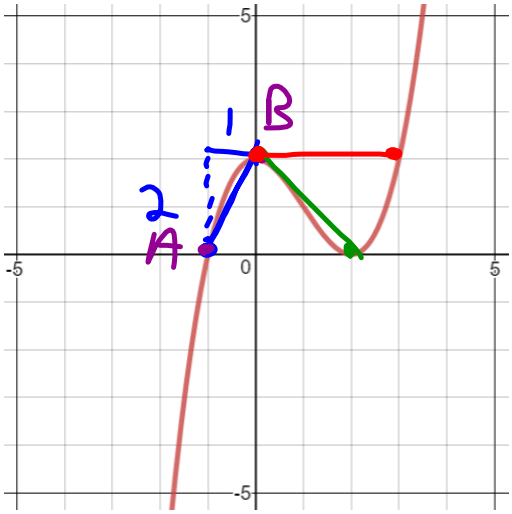
- the change in the dependent variable over a specific interval.

- The slope of the secant between two points on a curve.



$$\text{A.R.o.C.} = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Determine the average rate of change for the given function on the intervals:



a) [-1, 0]

A.R.o.C. = 2

A (-1, 0)
B (0, 2)

$= \frac{2-0}{0-(-1)}$

$= \frac{2}{1}$

b) [0, 2]

slope $= \frac{-2}{2}$

$= -1$

c) [0, 3]

A.R.o.C. $= \frac{0}{3}$

$= 0$

A football is kicked into the air and its height is given by the equation, $h(t) = -4.9t^2 + 14t + 1$

Determine the average rate of change of the height of the football during the first second. First two seconds.

$h(0) = -4.9(0)^2 + 14(0) + 1$

$= 1$

$h(1) = -4.9(1)^2 + 14(1) + 1$

$= 10.1$

R.O.C $[0,1]$

$\frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{10.1 - 1}{1 - 0}$

$= 9.1 m/s$

$h(0) = 1$

$h(2) = -4.9(2)^2 + 14(2) + 1$

$= 9.4$

R.O.C $[0,2]$

$= \frac{9.4 - 1}{2 - 0}$

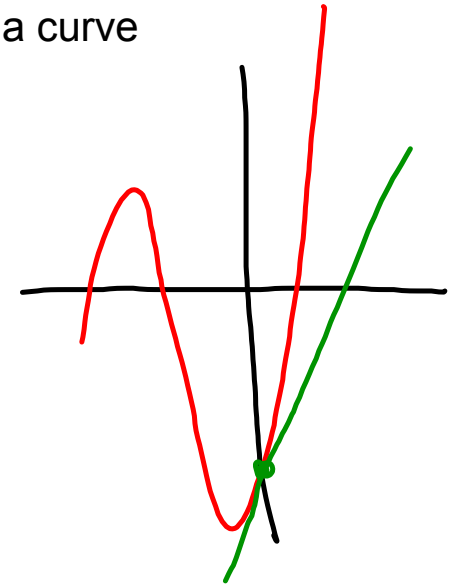
$= \frac{8.4}{2}$

$= 4.2 m/s$

Instantaneous Rate of Change

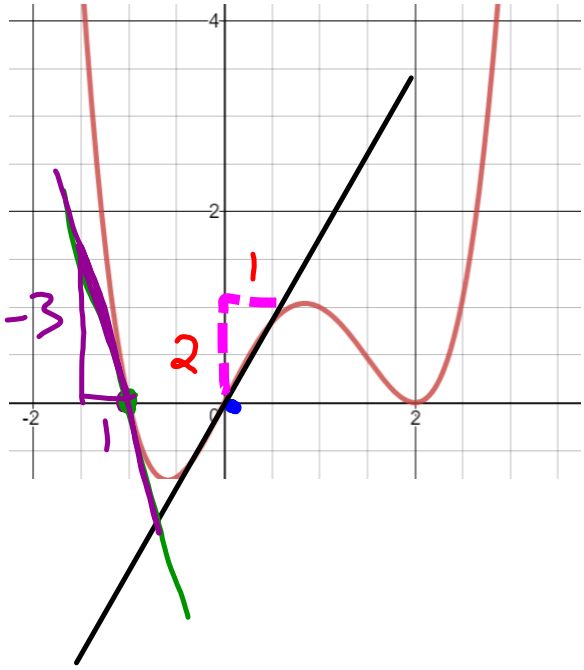
- change in the dependant variable at a specific point
- corresponds to the slope of a tangent of a curve

$$\text{I.R.o.C.} = \frac{y_2 - y_1}{x_2 - x_1}$$



Instantaneous rate of change could also be estimated using a graph

Estimate the rate of change of f(x) at the points (0, 0) and (-1, 0)



R.o.C (0)

$= \frac{2}{1}$

$= 2$

R.o.C at (-1, 0)

$= \frac{-3}{1}$

Estimate the instantaneous rate of change of the height of the football at 2 seconds

$h(t) = -4.9t^2 + 14t + 1$

Interval	$h(t) = -4.9t^2+14t+1$	Average Rate
(1, 2)	$h(1) = 10.1$ *from before* $h(2) = 9.4$	$\frac{10.1 - 9.4}{1 - 2}$ $= -0.7$
(1.9, 2)	$h(2) = 9.4$ $h(1.9) = -4.9(1.9)^2 + 14(1.9) + 1$ $= 9.911$	$\frac{9.911 - 9.4}{1.9 - 2}$ $= -5.11$
(1.99, 2)	$h(2) = 9.4$ $h(1.99) = 9.45551$	$\frac{9.4 - 9.45551}{2 - 1.99}$ $= -5.551$
(1.999, 2)	---------->	-5.55551

↓ approaching

-5.6

∴ the I.R.o.C at $t = 2$ can be estimated to be

-5.6 m/s

Homework

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