

Estimating Instantaneous Rates of Change

Part 1 (2.2)



"I understand the difference between average rate of change and (instantaneous) rate of change. Also, I can determine a reasonable estimate for the rate of change using the methods presented, and I can interpret the result. I can apply what I have learned in familiar and unfamiliar settings."

INVESTIGATEthe Math (Page 79, A - G)

Time, t (s)	6.0	6.2	6.4	6.6	6.8	7.0
Distance, $d(t)$ (cm)	208.39	221.76	235.41	249.31	263.46	277.84

(instantaneous) rate of change

Given a relation R , a **rate of change** is a change in the quantity of the dependent variable (y) relative to the change in the quantity of the independent variable (x), at $x = a$.

An **estimate** of the rate of change of y with respect to x is calculated using several different approaches:

preceding interval

an interval of the independent variable of the form $a - h \leq x \leq a$, where h is a small positive value; used to determine an average rate of change to estimate the (instantaneous) rate of change.

centred interval

an interval of the independent variable of the form $a - h \leq x \leq a + h$, where h is a small positive value; used to determine an average rate of change to estimate the (instantaneous) rate of change.

following interval

an interval of the independent variable of the form $a \leq x \leq a + h$, where h is a small positive value; used to determine an average rate of change to estimate the (instantaneous) rate of change.

EXAMPLE

A diver on the 10 m platform has the following heights above the water over time (seconds):

height	9.775	7.1	1.975
time	0.5	1	1.5

- Use **desmos** to determine a quadratic model.
- Estimate*, to the nearest tenth, the rate of change at 1.65 seconds (when she enters the water), by using at least three preceding intervals.
- Repeat part b) for at least three following intervals.

EXAMPLE

In the previous example, state three centered intervals that would create a reasonable estimate.

MathSIP: page 85 #2, 3, 8*, 12**, 16

*use all three methods (preceding, following centred)

** use **desmos**