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

(instananeous) 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 $a - h \le x \le a$, 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 $a - h \le x \le a + h$, 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 $a \le x \le a + h$, 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

a) Use desmos to determine a quadratic model.
b) *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.
c) Repeat part b) for at least three following intervals.

EXAMPLE

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

[1.55, 1.75] , [1.64 , 1.66] , [1.649, 1.651]

MathSIP: page 85 #2, 3, 8*, 12**, 16
*use all three methods (preceding, following centrered)
** use desmos

a) $y = -4.9x^2 + 2x + 10$

b) $1.55 \le x \le 1.65$

iroc $\approx$ aroc = ... = -13.68

$1.64 \le x \le 1.65$

iroc $\approx$ aroc = ... = -14.121

$1.649 \le x \le 1.65$

iroc $\approx$ aroc = ... = -14.1651

c) $1.65 \le x \le 1.75$

iroc $\approx$ aroc = ... = -14.811349

$1.65 \le x \le 1.66$

iroc $\approx$ aroc = ... = -14.219

$1.65 \le x \le 1.651$

iroc $\approx$ aroc = ... = -14.1749

"My guess is ... -14.17 ish //