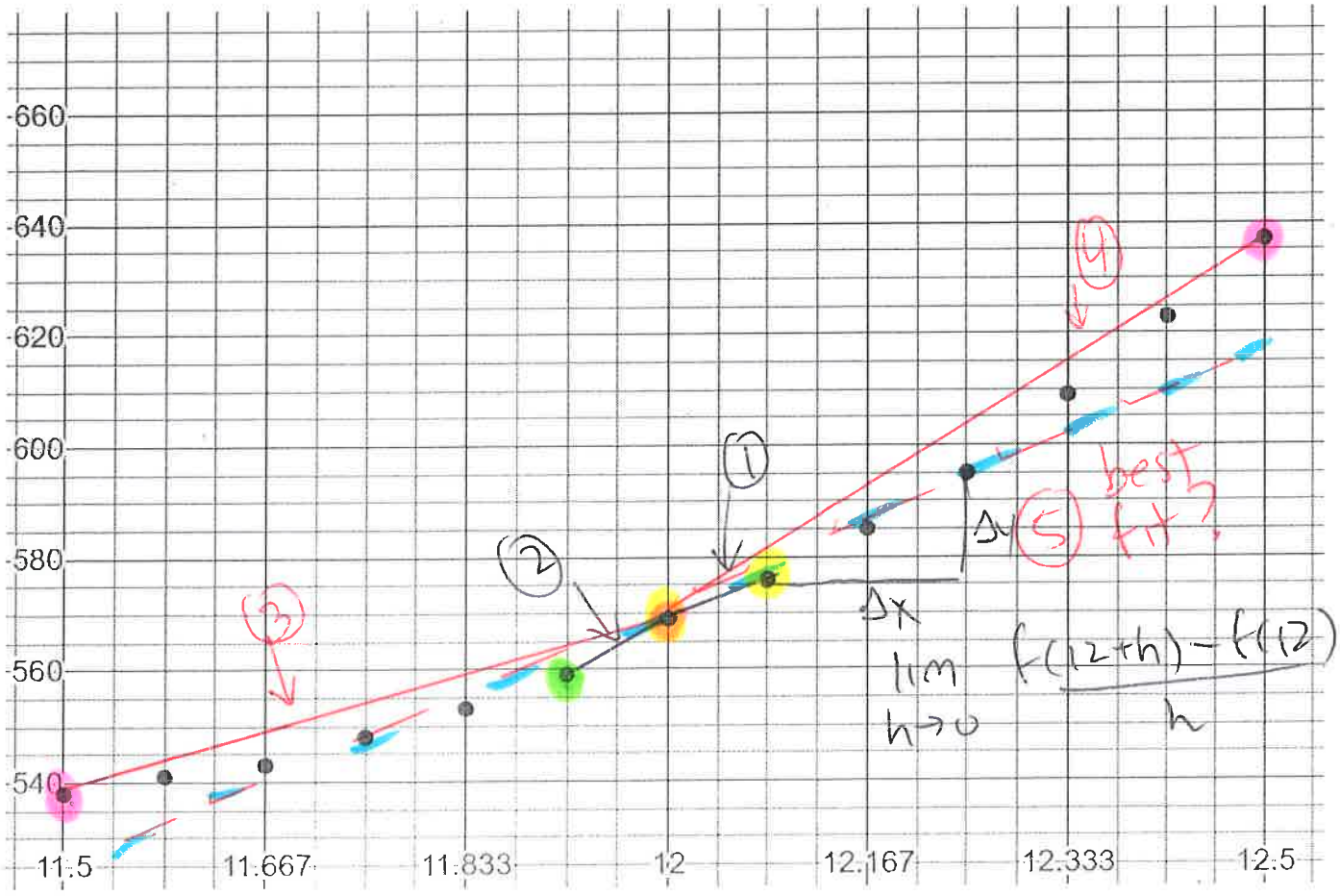
Instantaneous Rates of Change

Goal: • Understands that slope is $\frac{\Delta y}{\Delta x}$ whose units give us rate of change and this rate of change can be analyzed with a limit.
Terminology: • Average rate of change • Instantaneous rate of change
Reminders: • Quiz Monday Oct 7 • Test Friday Oct 11 • Get evidence up to date!

How would we determine how fast the water levels are changing at noon on September 7th?

Time	11:45	11:50	11:55	12:00	12:05	12:10	12:15
Height (mm)	548	553	559	569	576	585	595



① slope = 1.4 mm/min

average on [11:55, 12] $= \frac{576\text{mm} - 569\text{mm}}{5\text{ min}}$

look too different.

② avg slope = 2 mm/min on [12, 12:05]

↓

1.7 mm/min

"Best" average slope

③ Slope = $\frac{569\text{ mm} - 548\text{ mm}}{12\text{ h} - 11.45\text{ h}}$

avg on [11:45, 12)

$= 38.2\text{ mm/h} = 0.64\text{ mm/min}$

④ Slope = 173.3 mm/h = 2.89 mm/min

avg on [12, 12:15]

avg of ③ and ④ = 1.76 mm/min

Instantaneous rate of change using a limit

$$\lim_{h \to 0} \frac{f(12+h) - f(12)}{h}$$

Now just find f(x)

on [0, 24] Instantaneous slope = 1.96

on [11:45, 12:15) " " = 1.64

Practice Problems: 1.5: # 2, 3, 5, 6, 8, 9