Day 4 Agenda: **From Local Linearity to the Speed Limit Law**

SWBAT to identify a difference quotient in the context of a problem

SWBAT to use values of the derivative to estimate the value of the function in a context

SWBAT estimate the derivate and assign appropriate units given a table of values.

HW:Worksheet for Day 4 AND p. 116 #7, 19, 21, 23-26

0) Do Now: Caren's Bicycle (parts a and c) - (5 - 7min)

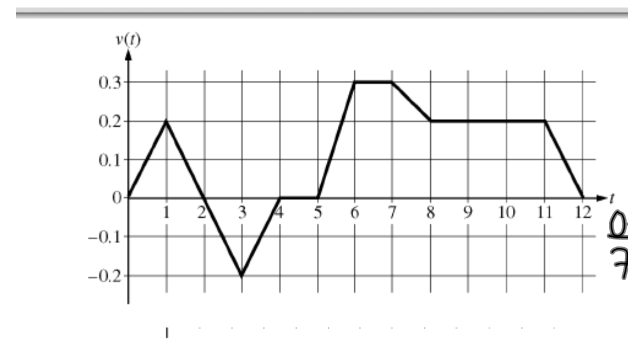
Return Tell the Story Checkin

1) Homework Q/A (7 min)

2) Letourneau Vacation Car Ride <u>Part a,b:</u> what questions can we answer? Sketch the Graph. (T-P-S) (5 min in small groups)

3) Letourneau Vacation Car Ride <u>Part c:</u> interpretations and estimations (10 minutes in small groups)

4) Rules and Expectations...The Review Card



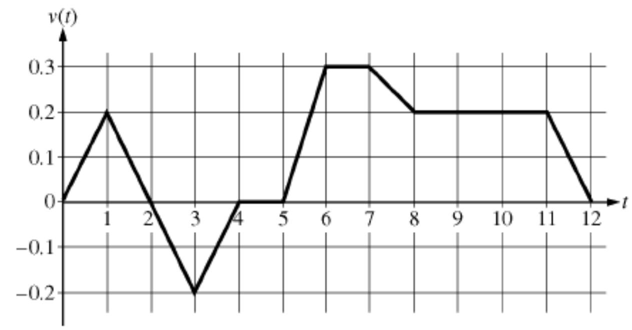
$\frac{0.3-0.2}{7-8} = -0.1$ miles/min^2

Caren rides her bicycle along a straight road from home to school, starting at home at time $t = 0$ minutes and arriving at school at time $t = 12$ minutes. During the time interval $0 \le t \le 12$ minutes, her velocity $v(t)$, in miles per minute, is modeled by the piecewise-linear function whose graph is shown above.

(a) Find the acceleration of Caren's bicycle at time $t = 7.5$ minutes. Indicate units of measure.

$a(t) = v'(t)$ = Slope of segment from $(7, 0.3)$ and $(8, 0.2)$

$$a(7.5) = v'(7.5) = -\frac{.1}{1}\ \frac{\text{mi/min}}{\text{min}} = \text{mi/min}^2$$



(c) Shortly after leaving home, Caren realizes she left her calculus homework at home, and she returns to get it. At what time does she turn around to go back home? Give a reason for your answer.

At $t=2$, velocity changes from positive to negative, indicates a change in direction.

(d) Larry also rides his bicycle along a straight road from home to school in 12 minutes. His velocity is modeled by the function w given by $w(t) = \frac{\pi}{15}\sin\left(\frac{\pi}{12}t\right)$, where $w(t)$ is in miles per minute for $0 \le t \le 12$ minutes. Who lives closer to school: Caren or Larry? Show the work that leads to your answer.

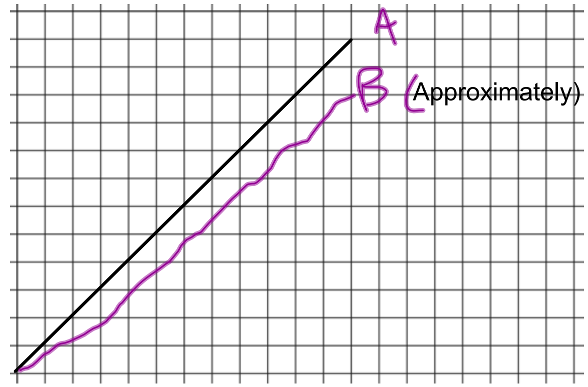
<u>Consider the following scenario:</u>

2 cars are traveling on the Massachusetts Turnpike traveling West. They pass through the EZPass high speed checkpoint at the same time, both going 60 mph. Car A turns on the cruise control for the next 30 min. without interruptions or traffic slow downs (I know, wishful thinking...). The cruise control for Car B is broken, but the driver is careful to never exceed 60 mph for the next 30 min. under the same driving conditions as Car A.

a) What Questions can we answer..what kinds of things could we do/model? (Think-Pair-Share)

- we can draw graphs of velocity
- we can draw graphs of position
- we know that Car A is never behind
- we know Car B could be behind and never ahead of Car A
- we can find the exact distance travelled by Car A
- We can find a bound (largest possible value) for the distance travelled by Car B

On the same set of axes, sketch a possible graph of two functions representing the **position** of Car A and Car B.



Mrs. Letourneau was in Car B while her husband was driving. She can't help but think like a Calculus Teacher, even when she's on a road trip, so she recorded the car's **position** relative to the EZPass checkpoint. Here is the data she collected:

t (minutes)	0	10	15	22	30
D (miles)	0	9.8	14.6	21.1	29.0

i. **Mrs. Letourneau performs the following calculation:** .
What quantity does this calculation represent in the context of this problem (use appropriate units)?

$$\frac{D(15)-D(10)}{15-10}$$

in miles/min

The average velocity of the car between 10 and 15 minutes

Estimating in Context September 9, 2016

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ii. What is the best estimate for the **velocity** of Car B at time t= 12 given the data provided? Represent this value using appropriate function notation.

?

$$V(t)=D'(t)\approx 0.96 \text{ miles/min (west)}$$

$$\doteq$$

$$V(t)=D'(t)\approx \frac{D(15)-D(10)}{15-10}=0.96 \text{ mi/min}$$

Mrs. Letourneau was in Car B while her husband was driving. She can't help but think like a Calculus Teacher, even when she's on a road trip, so she recorded the car's **position** relative to the EZPass checkpoint. Here is the data she collected:

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iii. At the 30 min. mark, Little Letourneau asks, "Are we there yet?" to which Mrs. Letourneau responds, "If Dad continues at the same rate he has been going for the last 8 minutes, we will be there in 10 more minutes." What is the mile marker at the Letourneau's final destination?

38.5 miles

Point-slope form $y = m(x - x_1) + y_1$

$y = .95(x - 30) + 29.0$

Tangent at 30 mins.

$y = .95(40 - 30) + 29.0$

$= 38.5$ miles