**Name:** ___________________________ **AP**

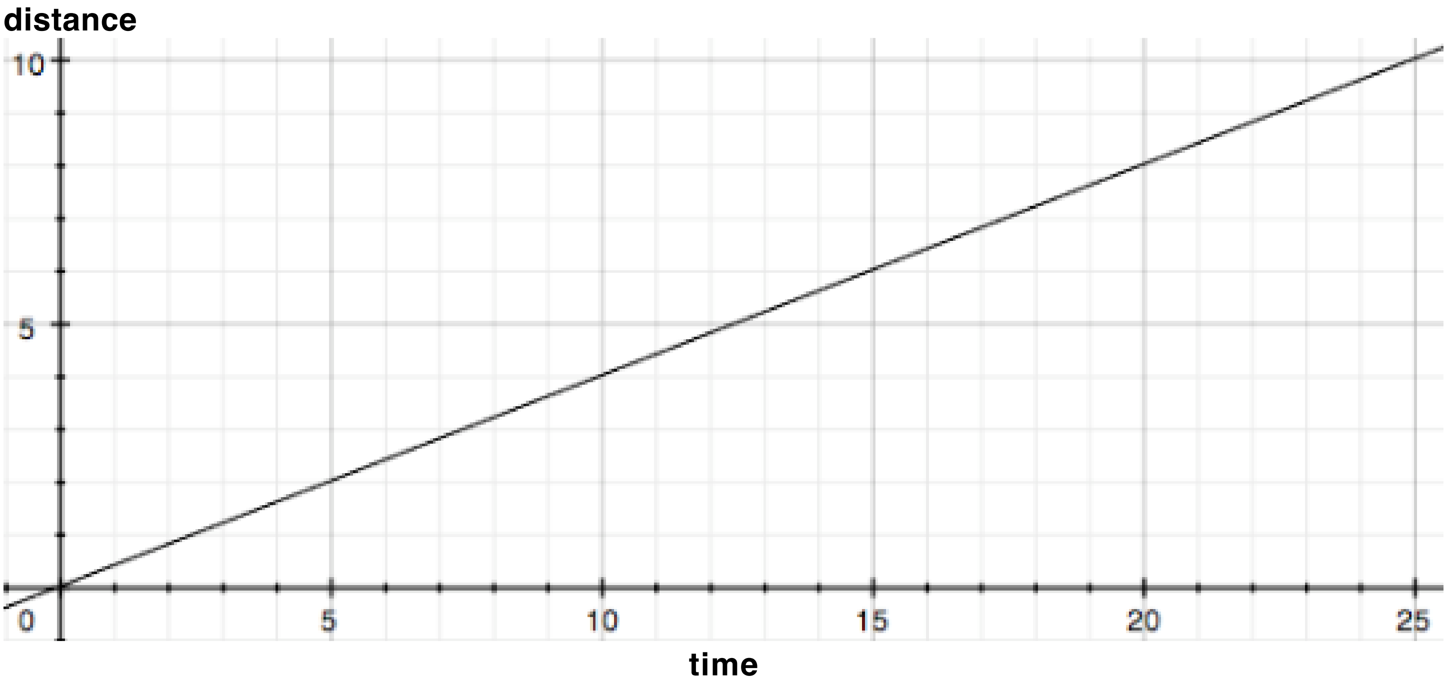
**Classwork 17**

1. Lily is climbing Mount Everest. 4 hours after the start of her climb, she is at an elevation of 12,000 ft. 12 hours into her climb, she is at an elevation of 12,200 ft.

a) Calculate Lily's vertical speed in that time interval (between t = 4 and t = 12).

b) Shocked at how slow she is going, Lily tries to figure out how far she climbed in the first 4 hours. In her head, she does 12,000 ÷ 4 and gets 3,000 ft per hour. Wait a second... Is that right?? Explain why or why not.

2. The following graph shows the motion of a coke bottle floating on the east river. Time is in minutes and distance is in meters.




a) Calculate the speed of the coke bottle. (Is there more than one way?)

b) What is the speed after exactly 15 minutes? Why?

3. **Picking up where we left off yesterday...**

Imagine that we had an equation to describe the motion of a boat in New York harbor. The equation is $d = 1/2t^3 + t^2 - 4t$. Put this graph into your calculator.

a) Why is this graph a smooth curve instead of line segments? Why is this realistic?

b) Let's say I wanted to find the **exact** speed at t = 2 minutes. The graph looks pretty curvy there... so write a limit expression to say what I am looking for.

c) Zoom in to your graph at x = 2 at least 10 times. What do you notice?

d) Go back to Y= and enter the graph y = 6x - 12 into Y2. Graph both of the functions at the same time. What do you see when you are zoomed in?

e) What do you see when you are zoomed **out**?

4. Imagine that we had an equation to describe the motion of a fly buzzing around someone else's hot, stuffy classroom. The equation is

$$d = \frac{1}{8}t^4 - \frac{1}{2}t^3 - t^2 + t + 12$$

a) Put this graph into your calculator. What do we use for **d** ? ____ What do we use for **t**? ____ Why?

b) How do we find speed using a distance vs. time graph?

c) Why can't we find the exact speed at one instance easily from this graph?

d) Zoom in to precisely x = 2. In order to make this work, you should trace along the graph until you get as close as possible to x = 2. Then press "Zoom"/ "Zoom In". Now trace again until you get as close as possible to x = 2. Zoom in again. Repeat this process several times. What happens?

e) Write a limit to express this zooming in process.

f) Go back to Y= and enter the graph $y = -5x + 18$ into Y2. Graph both of the functions at the same time **without changing your zoom**. What do you see?

g) What would you say is the **slope of the graph AT $x = 2$?**

h) Now zoom out. What do you see now?

i) Zoom in to $x = 0$ now using the same "Trace, zoom, trace, zoom" process.

j) Graph the line $y = x + 12$ in Y3 without deleting any of the other functions. Now graph again, staying zoomed in to $x = 0$. What do you see?

k) What would you say is the **slope of the graph AT $x = 0$?**

l) Zoom out. What do you see now?

m) Let's do one more. Zoom into $x = 4$.

n) Now enter into Y4 $y = x - 4$. Go back to your zoom. What do you notice?

o) What would you say is the **slope of the graph AT $x = 4$?**

p) Zoom out. What do you notice?

q) Describe the relationship between the straight lines and the curve. What is the mathematical name for their relationship?

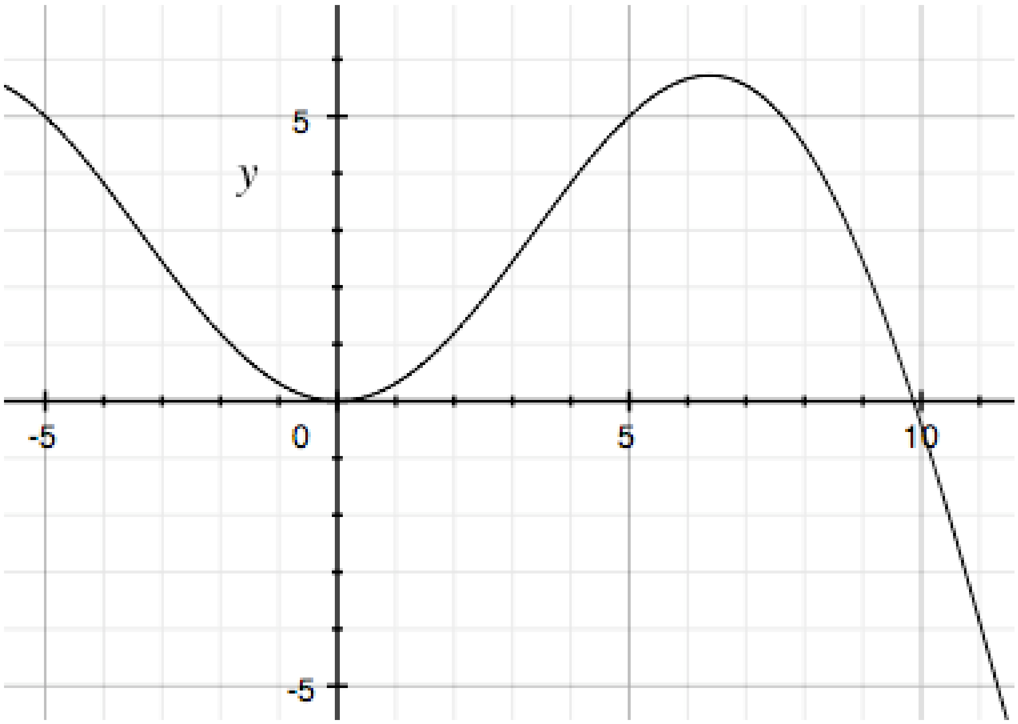
r) Let's say that y is in meters and x is in seconds. Based on what you just did, find the **instantaneous speed** of the fly at :

i) $t = 2$ ii) $t = 0$ iii) $t = 4$

Practice problems

1. At 2:15 pm the cross country team is 1 mile away from school. At 2:50 pm the team is 4.5 miles away from school. Find the team's average speed.

2. Use the graph below of distance versus time to answer the following questions.




a) What is the object's average speed between t = 0 and t = 5 ?

b) Draw a line on the graph to approximate the exact speet at t = 5