Name: ________________________ **AP**

Classwork 20

Warm up and review

1. Find the limit of

$$\sqrt{90 + \sqrt{90 + \sqrt{90 + \sqrt{90 \ldots}}}}$$

2. What is the relationship between slope and speed? Why does it exist?

3. Why do we need calclulus to find instantaneous speed or the slope at a point?

We will finally finish this question!!!

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) Zoom in to precisely x = 2. What happens?

We did this. It becomes a line.

b) 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?

We did this. They become the same line.

g) What would you say is the **slope of the graph AT x = 2?** -5, the same slope as the line.

Start here. Put the original equation and -5x + 18 into Y =...

h) Now zoom out. What do you see now?
Use **WINDOW: x min = 1 x max = 5 y min = -1 y max = 12**

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?**

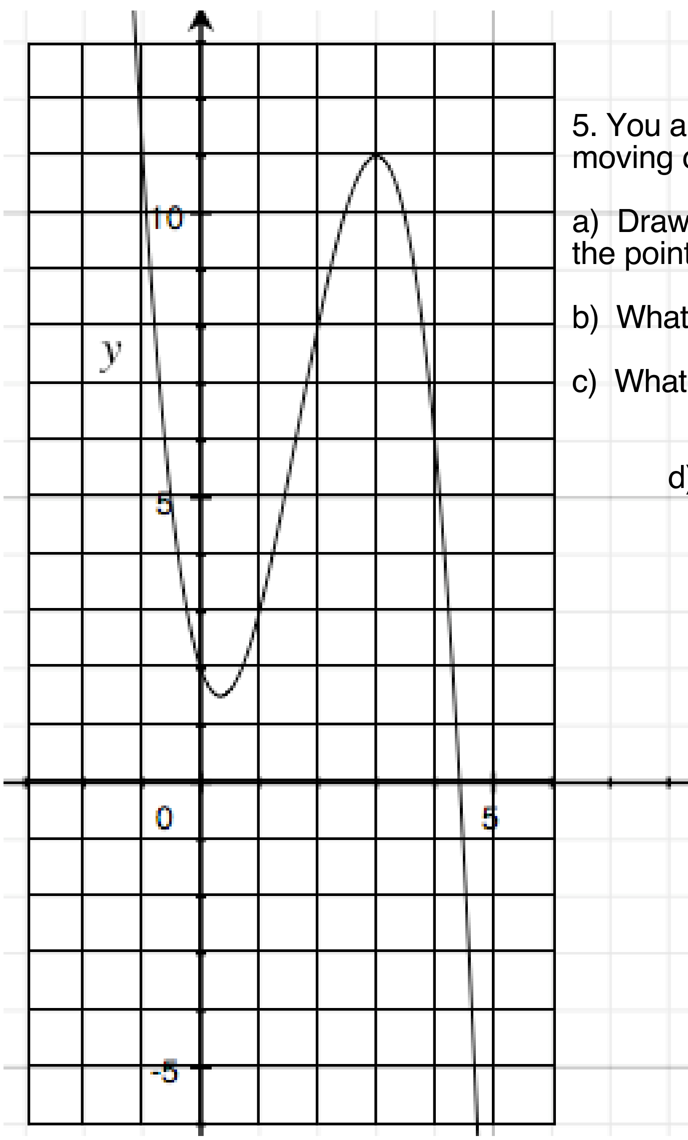
l) Zoom out. What do you see now?
Use **WINDOW: x min = -2 x max = 2 y min = 10 y max = 14**

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



5. You are given the graph of a function (left) of an object moving over time.

a) Draw a line on the graph below to approximate the slope at the point where x = 0

b) What is the intercept of that line?

c) What is the slope of that line?

d) The curve's equation is

$$y = -x^3 + 5x^2 - 3x + 2$$

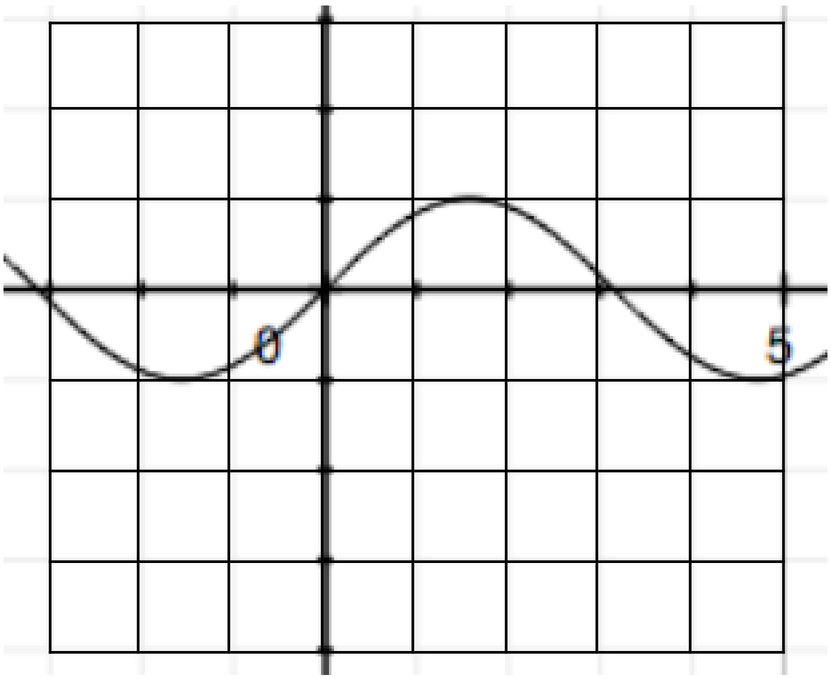
Enter this into Y1.

Now enter the equation of your tangent line into Y2.

Zoom into x = 0 to see if the slope you approximated is close.

5. a) Find the slope of the curve in the 2nd graph when x = 0.

b) Check your answer by graphing the original curve and your tangent line.



2. a) Use the distance vs. time graph on the next page to approximate the object's exact speed at $t = 0$

b) Write an equation for your tangent line.

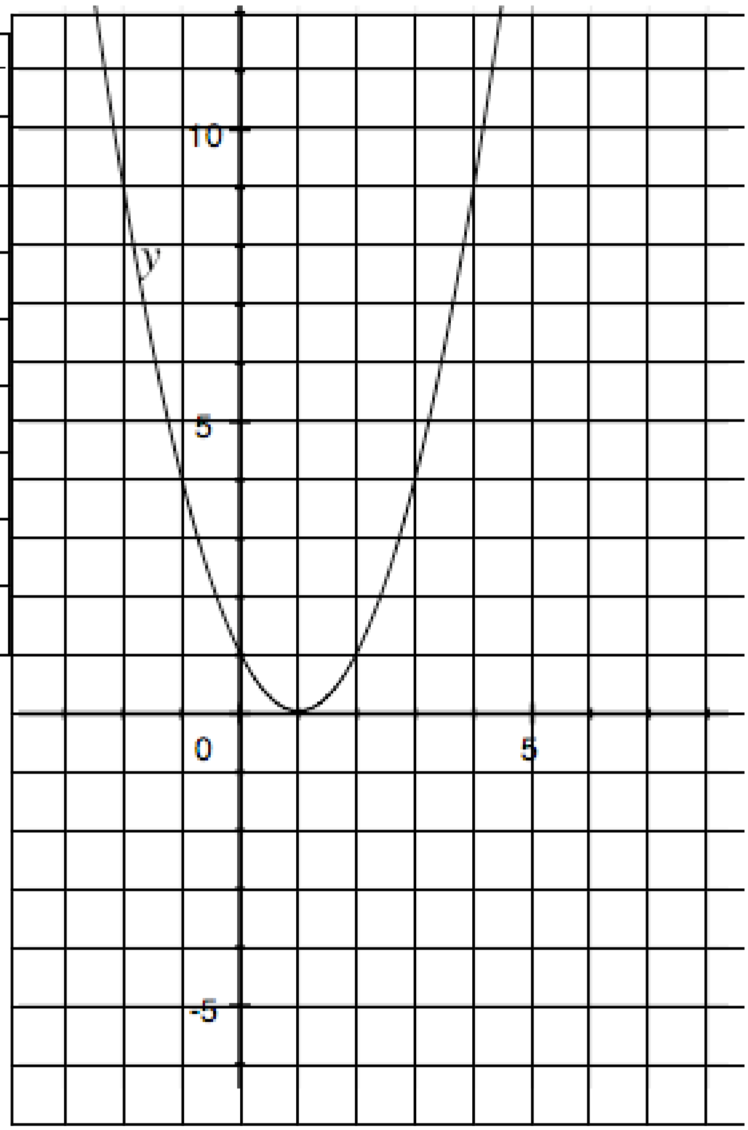
c) The original equation is $d = (t-1)^2$. Put both your original equation and the tangent line into the calculator. How well did you do? Zoom in to $x = 0$.

d) Let's see if there's another way we could figure out the slope (speed). What's the formula again?

e) What could we do to get an average speed that is really close to the instantaneous speed at $t = 0$?

Let's fill in the following chart:

x	**y**	**Slope between this point and (0, 1)**
1		
.5		
.1		
.01		
.001		
.0001		
.00001		
.000001		



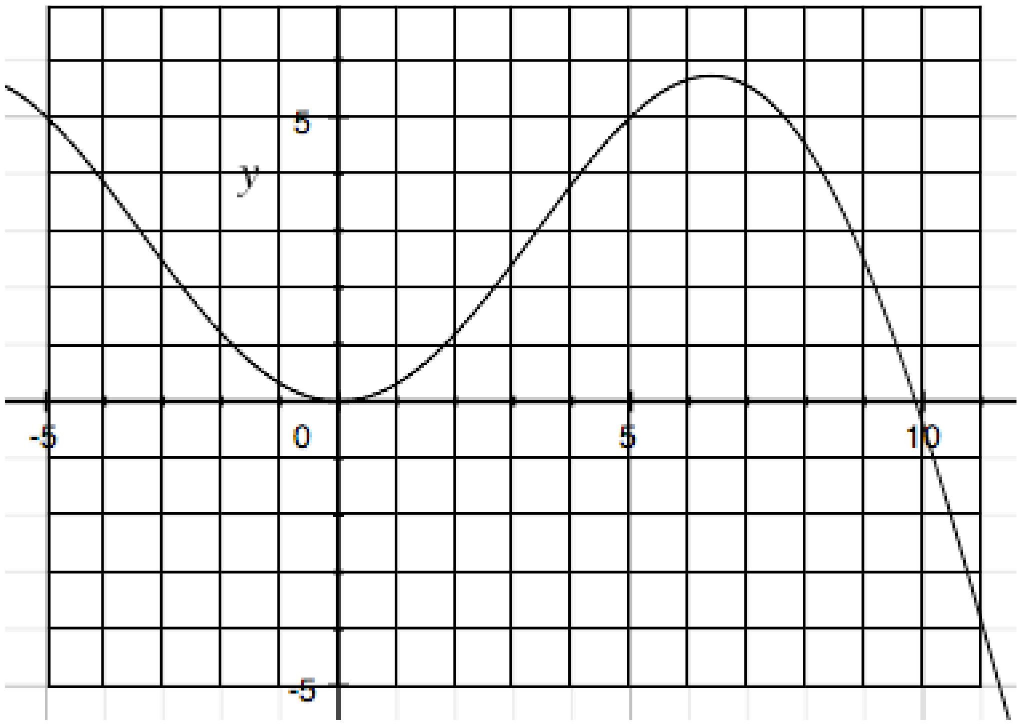
What are we doing to the point that we are using to find a slope with (0, 1)?

Let's say we renamed the difference between the x value we are using and 0 with the variable **h**. Write a limit to express what is happenning to **h.**

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

c) Based on your answer to (b), what is the approximate speed at exactly t = 5?