Name: _________________________ **AP**

Classwork 21

1. Write the formula for average speed

2. What is the difference between average speed and instantaneous speed?

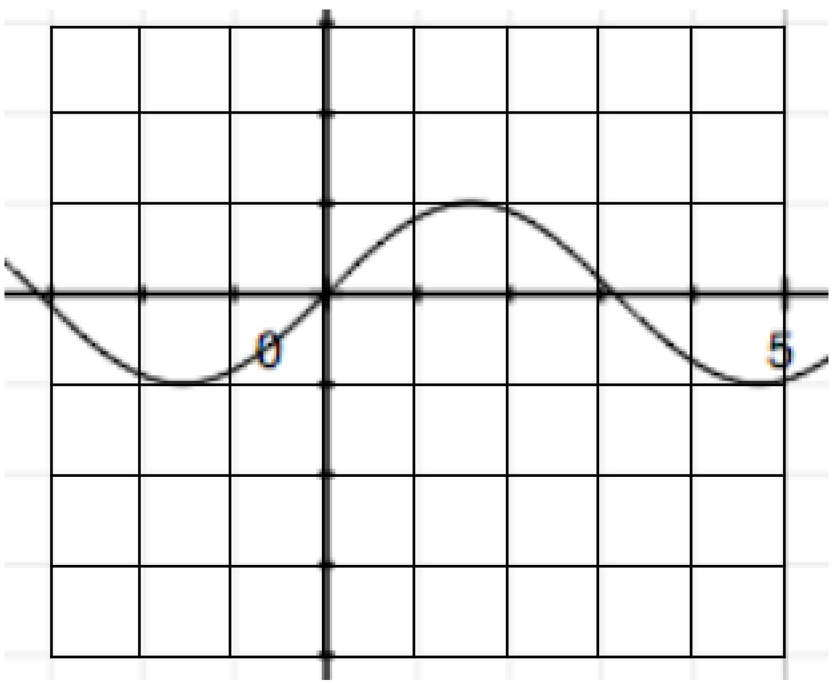
3. How can we find the slope of a curve where the angle of the graph is always changing?

4. a) Find the slope of the curve below at the following points:

   i. $x = 0$ ii. $x = 2$ iii. $x = -1$

   b) What is the equation of the tangent line at $x = 0$?

   b) Check your answer for $x = 0$ by graphing the original curve and your tangent line with the calculator.



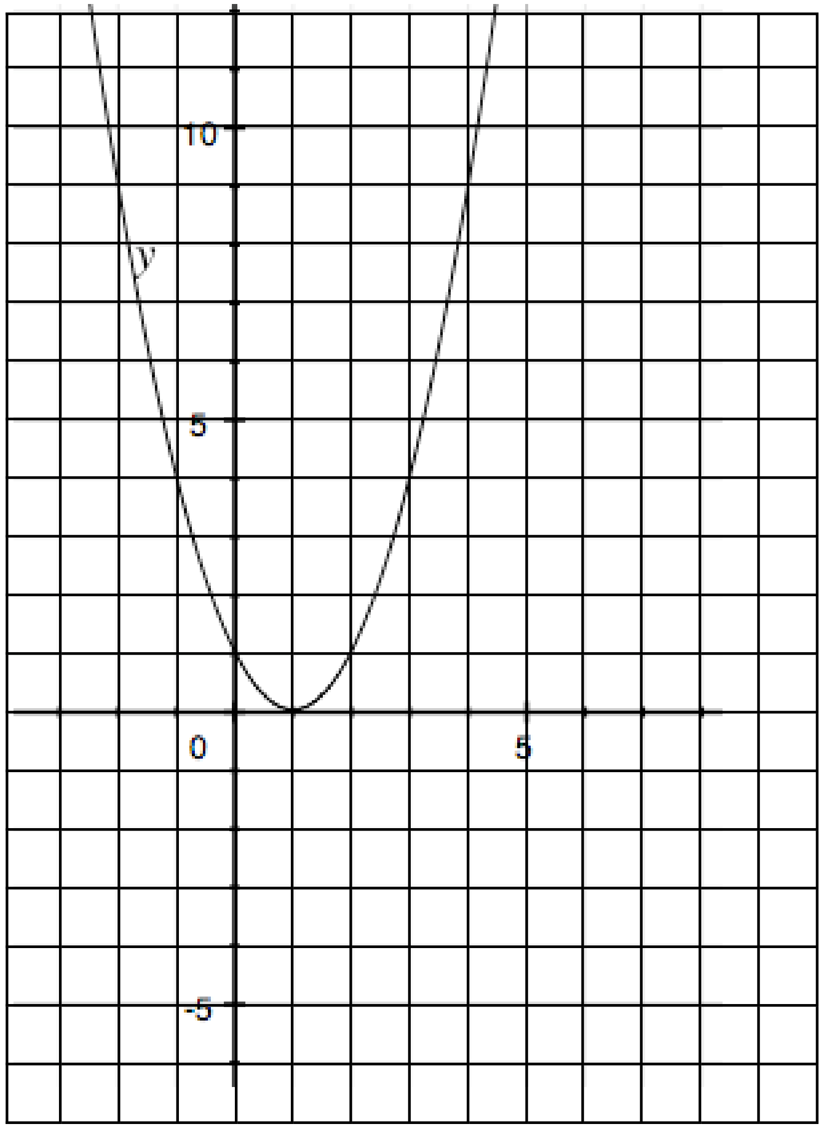
5. a) Use the distance vs. time graph on the next page to approximate the object's exact speed at $t = 0$

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		

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

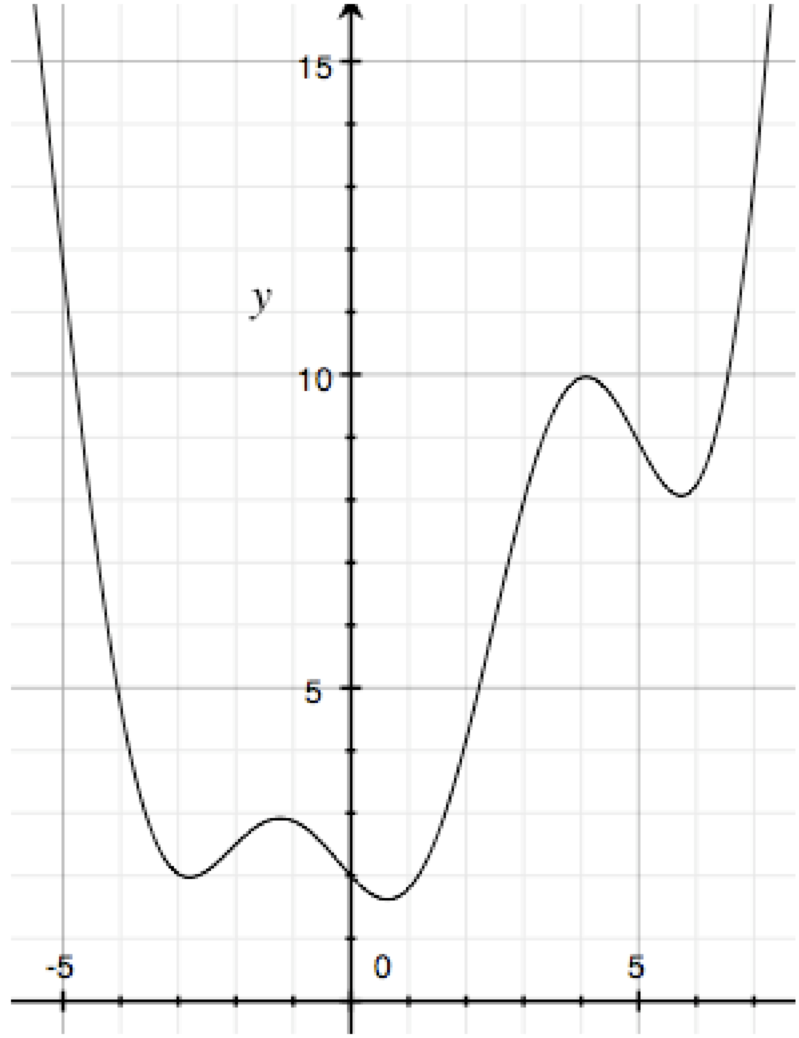
Let's say we renamed the difference between the x value we are using and 0 with the variable **h**. Write a limit to express what is happenning to **h** and what happens to the slope as a result**.**

6. a) Use the distance vs. time graph below to approximate the object's exact speed at:

i. t = 2

ii. t = -5

iii. t = 0



b) Write an equation for your tangent line for t = 0.

c) The original equation is

$$y = \frac{1}{3}x^2 - x\cos x + 2$$

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) Calculate the average speed (average slope) between t = -5 and t = 5.

f) Draw that average speed on the graph.

g) Why doesn't this tell us much about what is happenning around t = 0?

h) 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 for slopes between (0, 0) and a point nearby.

x	y	Δx	Δy	Slope
1				
.5				
.1				
.01				
.001				
.0001				

i) What is our approximation approaching? What would you say is the **exact** slope at x = 0 (t = 0) ?

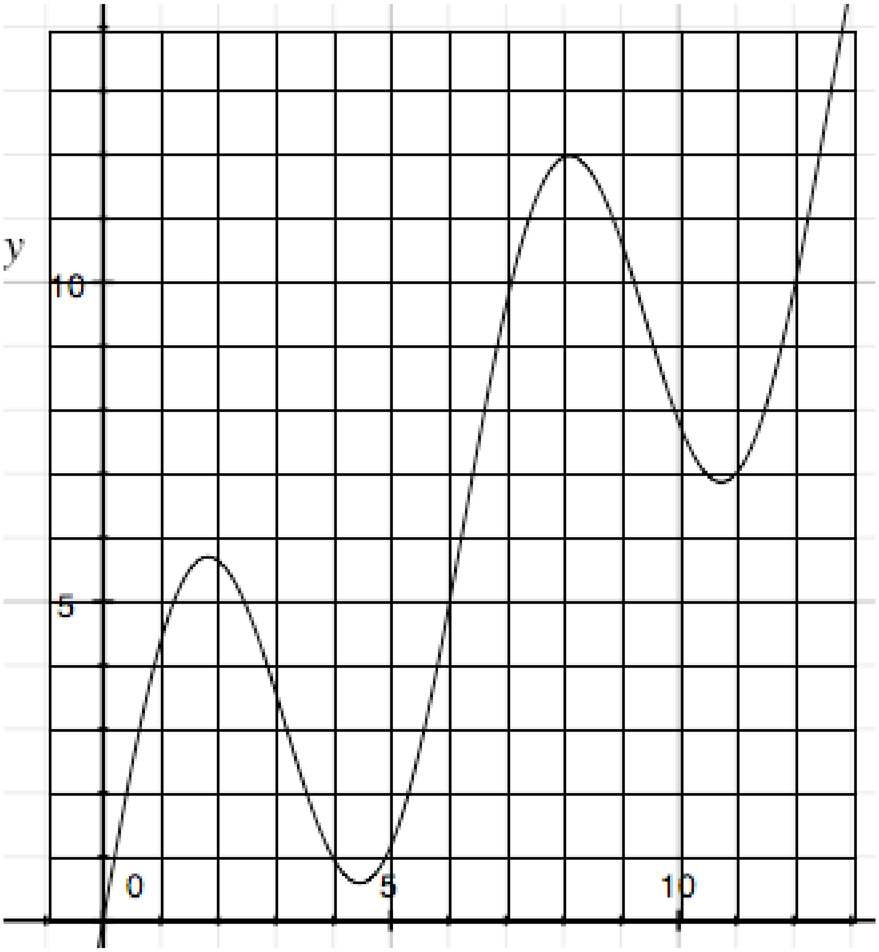
j) Why is this answer close to what the tangent line gave us?

k) What is happenning to Δx? What is happenning to Δy as a result? Explain why this indicates that calculus is going to be necessary.

l) 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 problem

1. Use the graph of $y = x + 4 \sin x$ below to answer the following questions.



a) Use the graph to approximate the slope of the graph at x = 5.

b) Find the average slope between x = 5 and a point very close to it.

c) Why do we have to use calculus to find the exact slope at x = 5?