Name: _____ **TC**

Classwork 17

1. Find $\lim_{x \to 0} \frac{x^3 - x^2}{x}$

2. Find $\lim_{x \to 0} \frac{x^3}{x^4 + x^2}$

3. Find $\lim_{x \to 0} \frac{3x - 6x}{2x - x}$

4. Lily is taking the elevator up to the 4th floor. At t = 1 minute the elevator is 10 feet above ground. At t= 3 minutes, the elevator is 35 feet in the air. Find the elevator's average spee d in that time interval.

5. Find the slope of the line between the points (1, 10) and (3, 35).

6. Did the elevator **necessarily** go at the average speed in #4 for the entire time interval? Explain.

7. Could a graph go from (1, 10) to (3, 35) without going in a straight line?

8. 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 $x = 4$?**

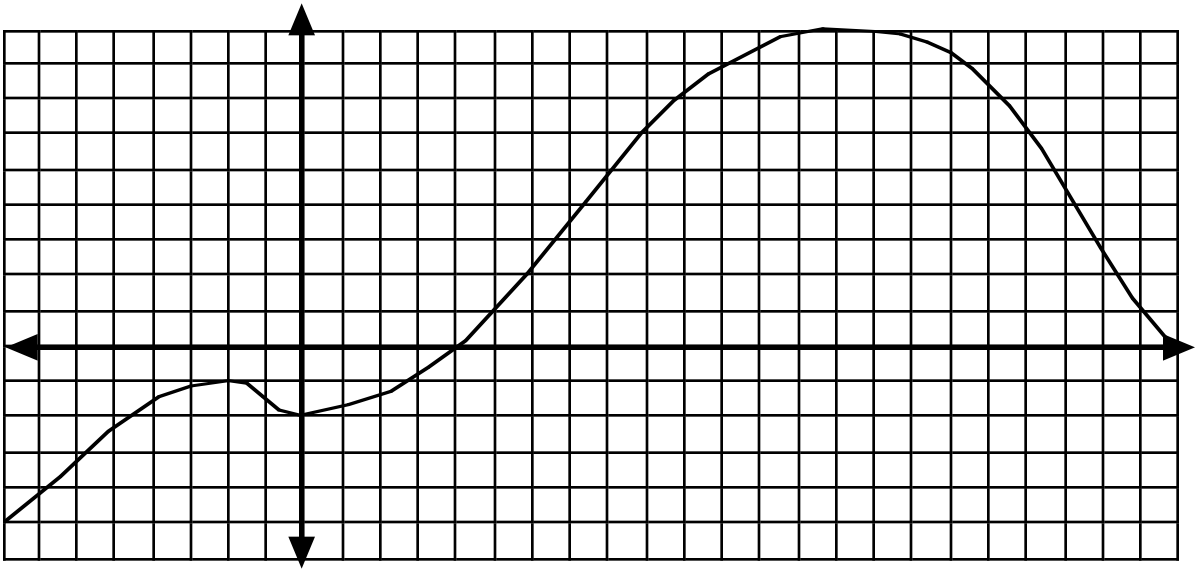
p) Zoom out. What do you notice?

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 :

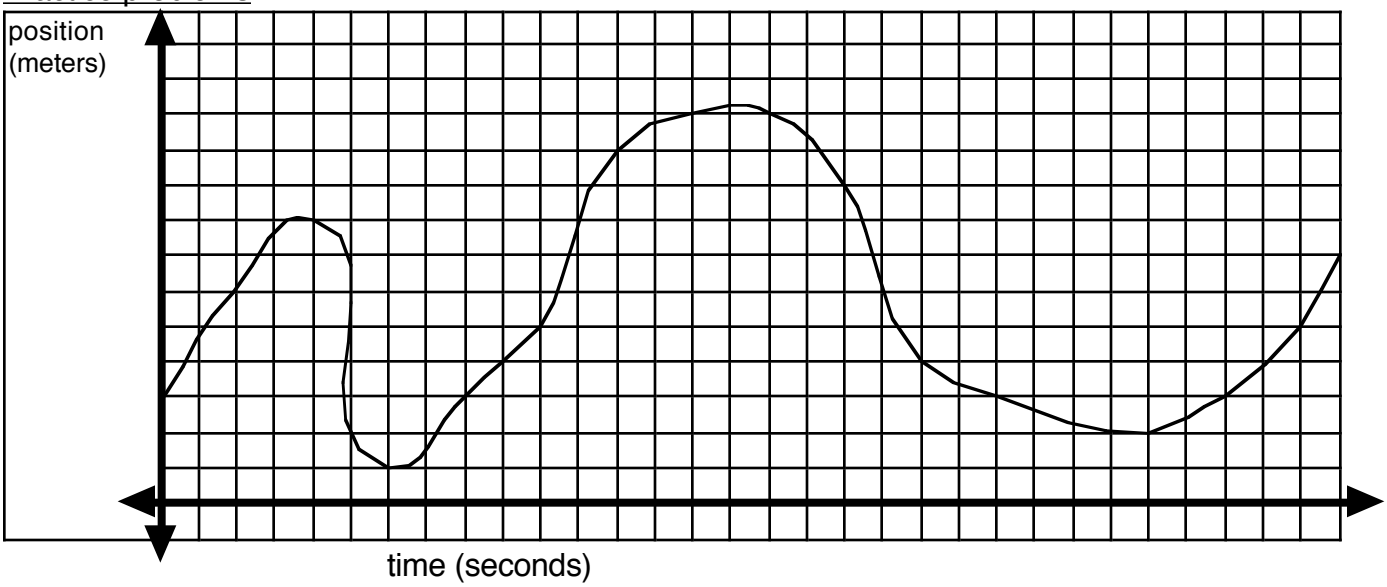
i) $t = 2$ ii) $t = 0$ iii) $t = 4$

9. a) Find the slope of the graph at x = 10 (you will have to approximate a bit)



b) If this was a graph of position in meters and time in seconds, how fast would the object be going at 10 seconds?

Practice problems



1. Find the *average* speed of the object over each **interval**.

   a) 4 s to 10 s b) 6 s to 12 s c) 14 s to 18 s d) 16s to 17 s

2. Draw a representation of the instantaneous speed of the object at 12 seconds on the graph.

3. Approximate the instantaneous speed of the object at 12 seconds.

4. Write a limit representing the instantaneous speed.