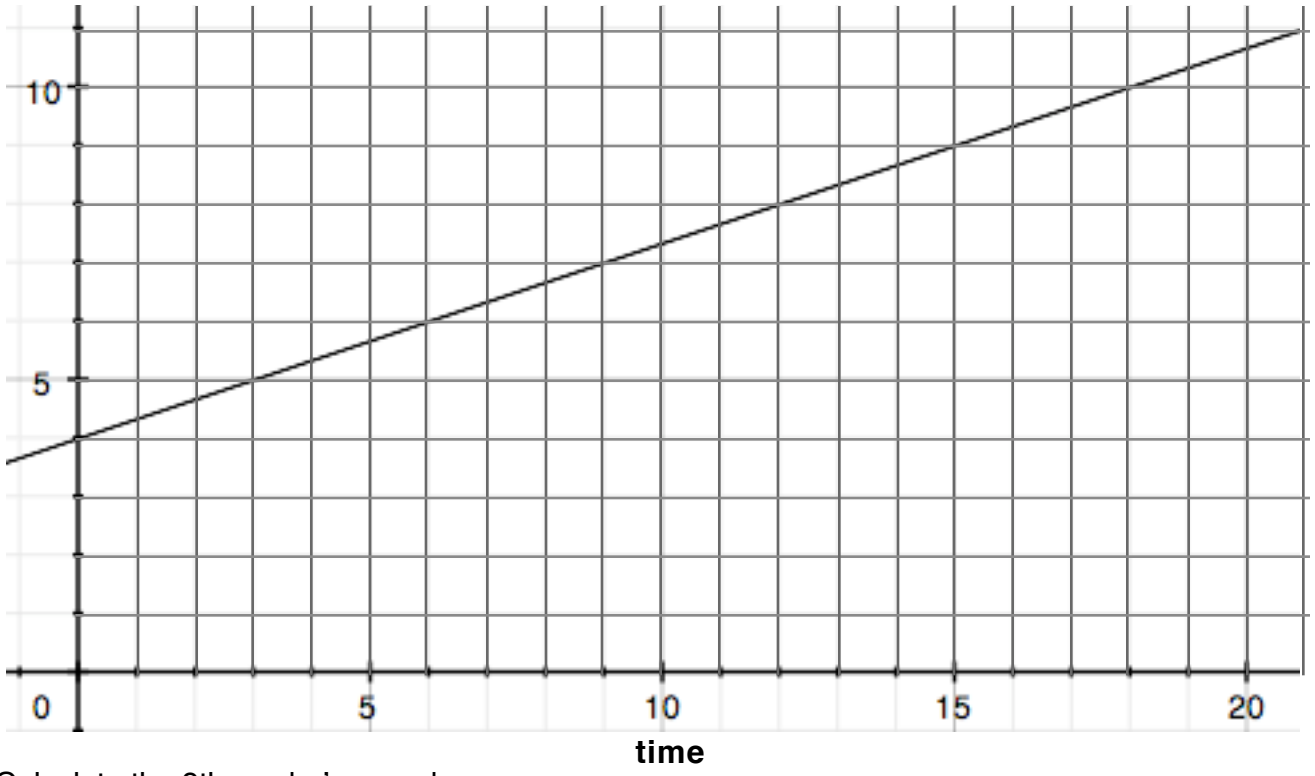
Name: _____ **TC**

Classwork 19

1. The following graph shows the motion of a 9th grader slipping on the ice, as video taped by the calculus class, which conveniently put down a number line. Position is in feet and time is in seconds.



a) Calculate the 9th grader's speed.

b) Jorge does Distance/time = 9 ft/ 7 s = 1.28 ft/s. Carlos does Distance/time = 15 ft/9 s = 1.67 ft/s. Jessica says that from the graph, it looks like the 9th grader is moving at a constant speed. What is going on??

c) Find the 9th grader's speed at exactly 5 seconds.

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 $x = 0$.

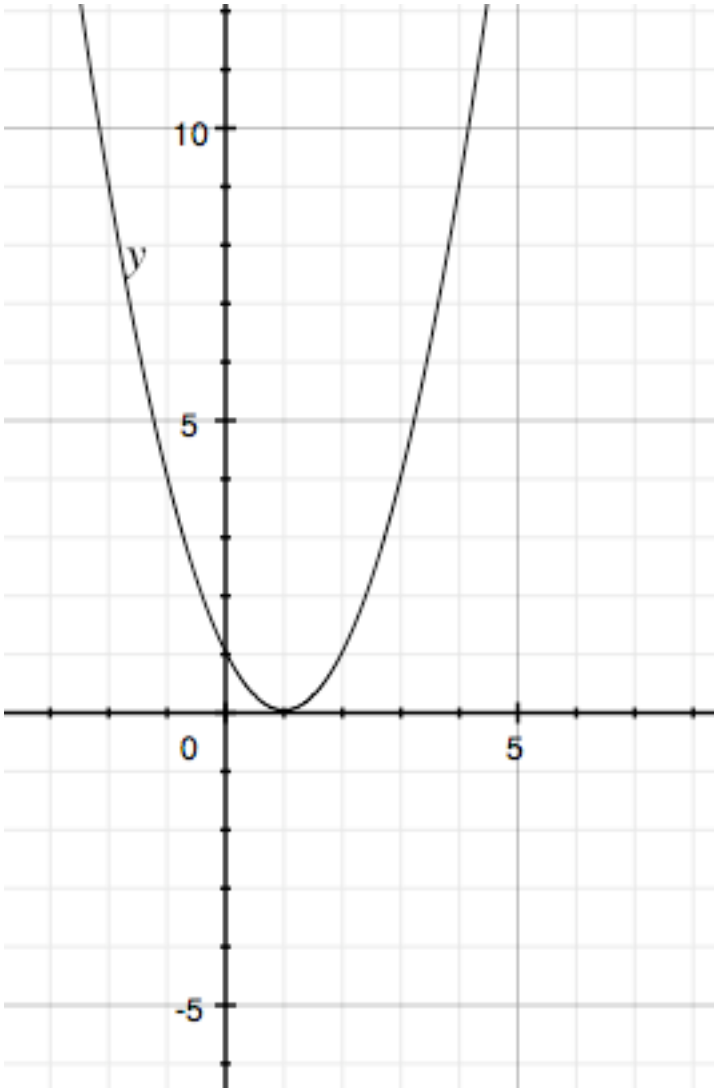
d) Let's see if there's another way we could figure out the slope (speed). What's the formula again?

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)?

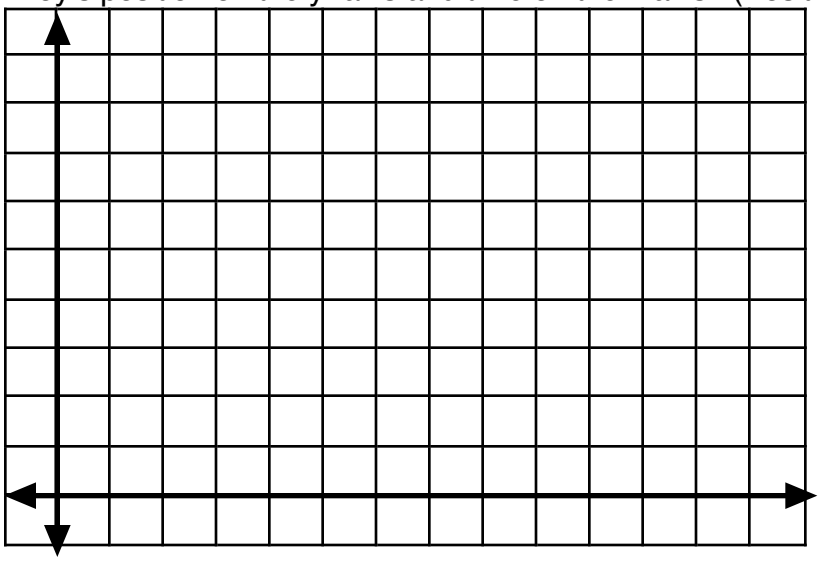


Let's say we renamed the difference between the x value we are using and 0 with the variable **h**. Write a limit to express what is happenning to **h.**

1. Roy is biking around Brooklyn. His position over time is described by the equation

$y = -1/2x^2 + 4x$

a) Graph Roy's position on the y- axis and time on the x-axis. (Position is in miles and time is in hours.)



b) Find the average speed over each interval.

i. 0 hours to 6 hours

ii. 1 hour to 5 hours

iii. 2 hours to 4 hours

iv. 2.5 hours to 3.5 hours
(hint: use the equation, not the graph)

v. 2.8 hours to 3.2 hours

vi. 2.9 hours to 3.1 hours

vii. 2.95 hours to 3.05 hours

viii. 2.999 hours to 3.001 hours

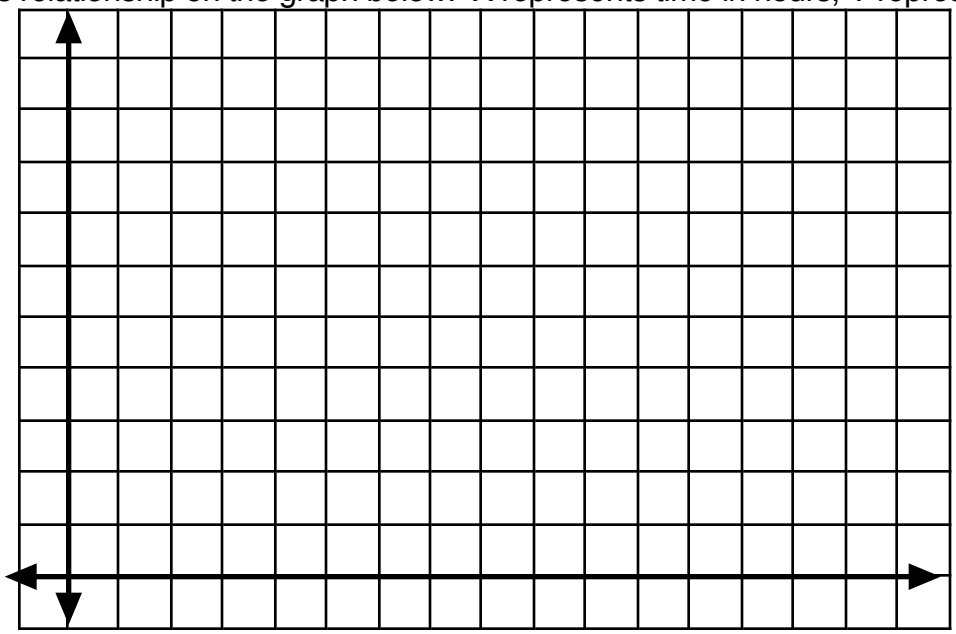
c) What do you predict for the **instantaneous speed** at 3 hours?

d) Find the instantaneous speed at 3 hours using the graph.

e) Write a **limit expression** for the instantaneous speed.

2. The relationship between time and how much snow is on the ground is described by
$y = 1/4x^3 - 3x^2 + 10x$

a) Graph this relationship on the graph below. X represents time in hours, Y represents snow in inches.



b) When is the snow falling fastest?

c) When does the snow start to melt?

d) Find the average rate of snowfall for each interval.

i. 6 hours to 8 hours

ii. 6.5 hours to 7.5 hours

iii. 6.9 hours to 7.1 hours

iv. 6.99 hours to 7.01 hours

e) Estimate the instantaneous rate of snowfall at 7 hours.

f) Write a limit expression for the instantaneous rate of snowfall at 7 hours.

g). Suppose after 7 hours the snow simply continues accumulating at the same rate for the next hour. In New York city, 17 inches must be on the ground for the city to close school. Will there be enough snow for a snow day?

Practice Problem

1. The distance travelled by a bird over time is described by $y = 0.2x^3 - x$. Y represents distance in miles and x represents time in hours.

a) Make a graph of the position of the bird over time.

b) Calculate the average speed using intervals near $x = 4$.

c) What is the instantaneous speed at $x = 4$?

d) Show on the graph how you could find instantaneous speed.