Slopes of Tangent Lines

$$f(x) = x^2$$

1. Use a rise-run triangle to find the slope of each tangent line.

   at x = 1, m =

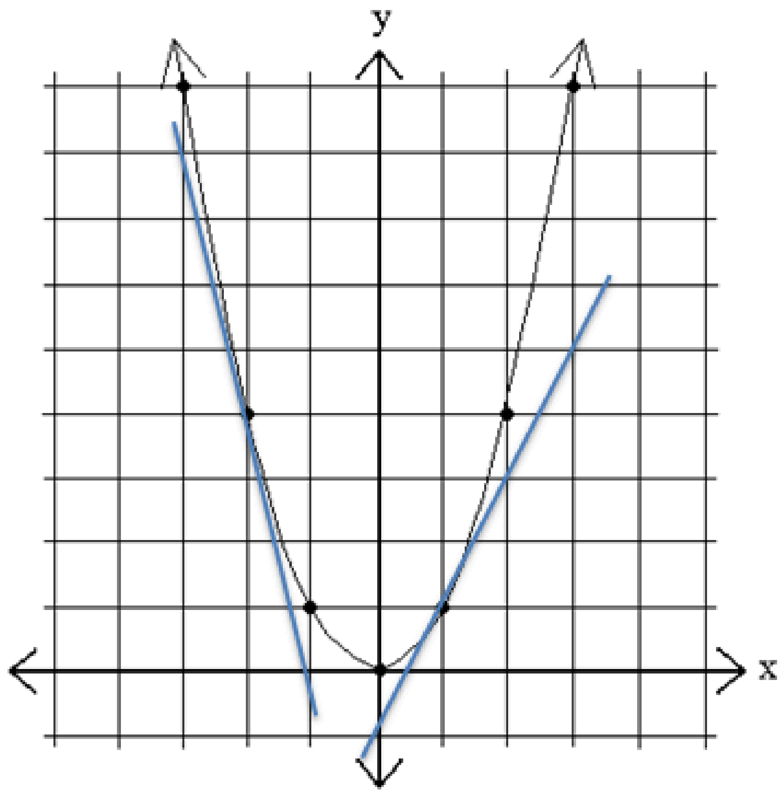
   at x = -2, m =

4. Now, use the derivative of f(x) to find the slope.

$$f'(x) = \_\_\_\_$$

at x = 1 , m =

at x = -2, m =

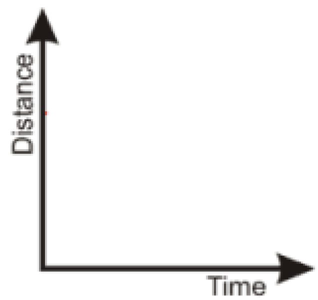


Warm-Up:

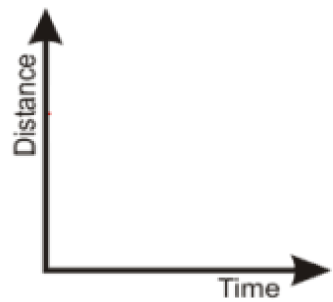
Sketch in a graph for each situation described below.

a) someone who is moving at a constant slow speed

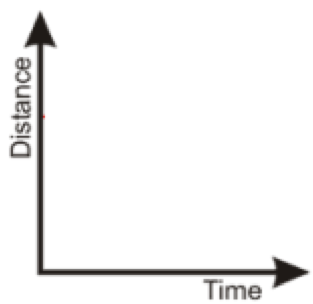
b) someone who is moving at a constant quick speed



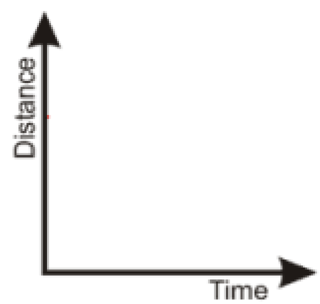
c) someone who is speeding up



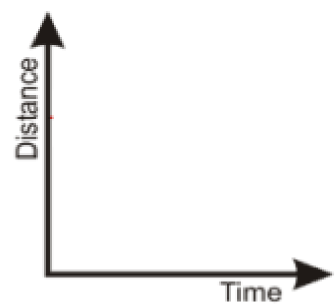
d) someone who is slowing down



e) someone who has moved but now is stopped



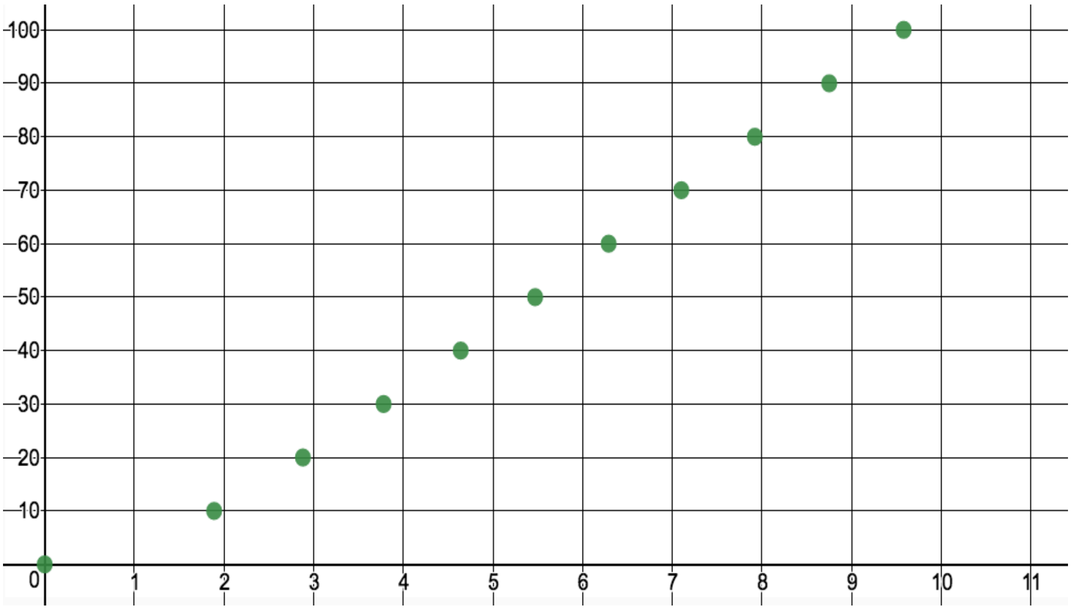
f) someone who is running back to their starting place at an increasing rate



<u>**Introductory Activity: Who is the Fastest of Us All**</u>**?**

The data plotted below shows Usain Bolt's times at each 10 meter interval during his world record race (9.58 seconds) at the World Championships in Berlin in 2009.

a) Connect the data points with a smooth curve.



Data for Lucain Volt

x_2	y
0	0
7.5	10
8.5	20
9.2	30
9.6	40
10	50
10.3	60
10.5	70
10.7	80
10.9	90
11.1	100

b) Add the data points for a lesser known runner, Lucain Volt. Connect with a smooth curve.

c) Describe Usain's race.

d) Describe Lucain's race.

e) Who is the faster runner? Explain.

f) What is Lucain's average speed?

g) What is Lucain's speed at the moment in time, t = 7.5 seconds?

Use t = 7.5 and t=10 first.

Now, try using t = 7.5 and t = 8.5.

h) Which of the above slopes is a better representation of Lucain's speed at the exact moment, t = 7.5 ?

i) Could we find the slope *<u>right at</u>* our selected moment in time? How? Explain.

Find the derivative of:

4 Find $\frac{dy}{dx}$ for each function.

a

b

c

Final Challenge Problem:

A particle moves in a straight line so that its position from its starting point at any time t in seconds is given by $s = 3t^2$, where s is in metres. The particle passes though a certain point when $t = a$ and then sometime later though another point when $t = a + h$.

a) Find the average speed from $t = a$ to $t = a+h$, in terms of a and h.
b) Find the *instantaneous velocity* (slope of tangent) at t = a.
   (i) Using the definition of a derivative
   (ii) Using the power rule shortcut.