

# Lab: Secant lines

**Exercise 0.0.1.** Let  $f(x) = 3x + 5$ .

- (a) What is  $f(2)$ ?
- (b) What is  $f(7)$ ?
- (c) Consider the two points  $P = (2, f(2))$  and  $Q = (7, f(7))$ . (If this notation is confusing, you may want to plug in the actual numbers you got for  $f(2)$  and  $f(7)$  in the previous parts.) Find the slope of the line between these two points.

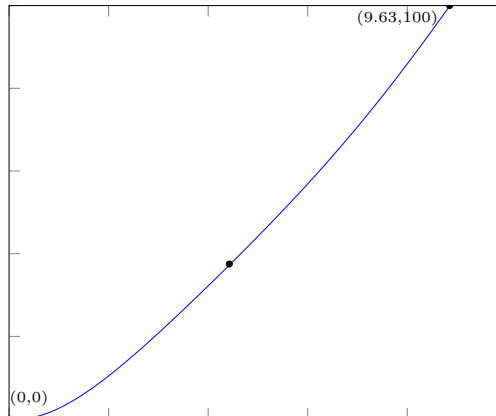
**Exercise 0.0.2.** Let  $f(x) = x^2 - 3$ .

- (a) What is  $f(2)$ ?
- (b) What is  $f(7)$ ?
- (c) Consider the two points  $P = (2, f(2))$  and  $Q = (7, f(7))$ . Find the slope of the line between these two points.
- (d) Draw the graph of  $f(x)$ . You can use a graphing calculator to help you draw if you like. (There are plenty online.) However, I do recommend you draw the graph on a sheet of paper—you'll be doing some drawing in the next few parts.
- (e) On the same picture, draw the line passing through  $P$  and  $Q$ .
- (f) Now let  $Q_1$  be the point given by  $(5, f(5))$ . Draw the line passing through  $P$  and  $Q_1$ .
- (g) Now let  $Q_2$  be the point given by  $(4, f(4))$ . Draw the line passing through  $P$  and  $Q_2$ .
- (h) Now let  $Q_3$  be the point given by  $(3, f(3))$ . Draw the line passing through  $P$  and  $Q_3$ .

- (i) Is there any observation you can make about the lines you've drawn?

**Exercise 0.0.3.** In the 2012 London Summer Olympics, Usain Bolt ran 100 meters in 9.63 seconds. (A meter is a little more than a yard; roughly, he ran across a football field and then some in 9.63 seconds.) This was—and still is—an Olympic record, and Usain Bolt won a gold medal for his run.

- (a) In meters per second, how fast would you say Usain Bolt ran during his run? (You can use a calculator if you like.)
- (b) Think about your answer to the previous part of this problem, and discuss with your group: Do you think Usain Bolt was running at that speed for the entirety of those 9.63 seconds? Was he moving slower during certain points of time? Faster?
- (c) Below is a position-versus-time graph estimating Usain Bolt's actual run. Can you identify some parts of the graph that capture moments when Bolt was running *slower* than the speed you got in the first part of this problem? *Faster*?



- (d) The black dot in the graph has  $t$ -coordinate 4.8. Is there a way you might try to estimate Usain Bolt's speed at that time? Put another way: If Usain Bolt had a speedometer on him, what might that speedometer have read at time  $t = 4.8$ ? (This is not an answer that is "known." So feel free to brainstorm and be creative with your group!)