

## Lab 2: Exploring derivatives

Names:

### Goal

Develop more intuition about derivatives by exploring a few examples.

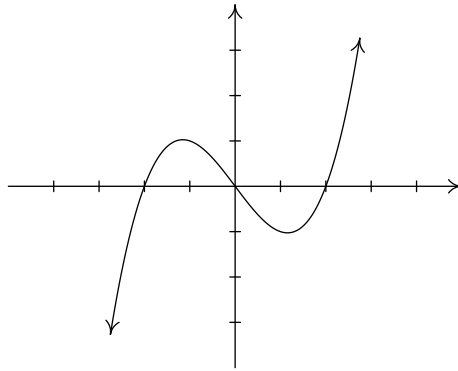
### Directions

In groups of 2–4, answer each of the following questions in the space provided. You only need to turn in one lab per group (make sure you put everyone's name on this sheet). The lab is due on **Wed, Mar 11** and is worth 10 points.

### Exercises

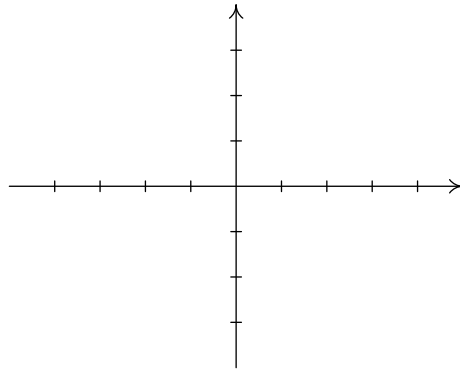
1. Suppose that  $f$  is a differentiable function. Explain the difference between  $f'(x)$  and  $f'(5)$ .
2. Let  $f(x) = 3x^2 + 5x$  and  $g(x) = 3x^2 + 5x + 2$ .
  - (a) Explain how the graphs of  $f$  and  $g$  are different. (Hint: how would you obtain the graph of  $g$  from the graph of  $f$ ?)
  - (b) Using our shortcuts for derivatives that we developed in section 3.3, find the derivatives of  $f$  and  $g$ .
  - (c) Explain the similarity between the answers that you got for the derivatives in part (b). In particular, appeal to the similarities between the graphs of  $f$  and  $g$  to justify the similarity in their derivatives.

3. Suppose that  $f$  is a differentiable function with the following graph.



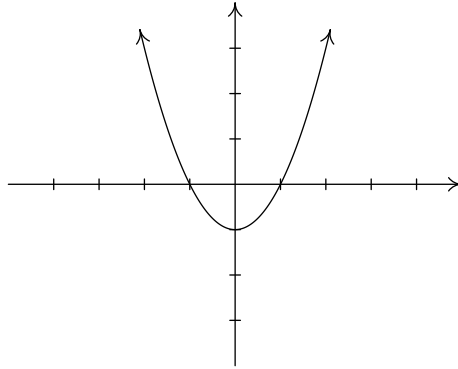
Using the graph of  $f$ , answer each of the following questions.

- (a) At what  $x$ -values is  $f'(x) = 0$ ?
- (b) On what (open) interval(s) is  $f'(x) > 0$ ?
- (c) On what (open) interval(s) is  $f'(x) < 0$ ?
- (d) Using the information that you found in parts (a), (b), and (c), sketch a possible graph for  $f'$ .



- (e) Using your graph for  $f'$ , estimate the interval(s) on which  $f''(x) > 0$ .
- (f) Using your graph for  $f'$ , estimate the interval(s) on which  $f''(x) < 0$ .
- (g) Do you have any guesses as to what information  $f''$  may tell us about the original graph of  $f$ ?

4. Suppose that  $g$  is a differentiable function and its *derivative* has the following graph.



Using the graph of  $g'$ , answer each of the following questions.

- (a) On what (open) interval(s) is the graph of  $g$  increasing from left to right?
- (b) On what (open) interval(s) is the graph of  $g$  decreasing from left to right?
- (c) At what  $x$ -values does the graph of  $g$  have a turning point (i.e., a point where the graph changes from increasing to decreasing or vice versa)?
- (d) Using the information that you found in parts (a), (b), and (c) sketch a possible graph for  $g$ .

