Math 130 Day 14

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

Homework

Review your test and answers. Come see me if you need to. Today we will investigate the relationship between differentiability and continuity. Review 3.1 and read 3.2.

1. Memorize the definition of $f'(x)$ using $h \to 0$ on page 130. This is on the next quiz and Exam 2.

2. a) Here are several problems. To master the ideas in Chapter 3.1, You need to do a lot of practice. Page 133ff: #5, 6, 8. Now practice using the definition of the derivative: 13, 19, 37, 39.

b) Using geometry and the derivative: Page 141 #5, 7, 9, 11 39, 41, 43, 53. And then page 134 #53.

c) Differentiability and continuity: Page 142 #15.

Hand In at Lab

Do the Lab Ticket and bring to lab tomorrow.

Hand In Friday

Review your class notes. **Graph paper** is available at the link at the course website.

0. Work on WeBWorK Set Day 14A due Friday night.

1. Page 133 #50.

2. Suppose that we have a general parabola $f(x) = ax^2 + bx + c$ where a, b, and c are (unknown) constants. Find $f'(x)$. It's not hard! Just work out the definition.

3. Page 141 #6. **Recopy** the graph (else no credit). See Example 1 in Section 3.2. Your answer should be very accurate. (See the answer to #5.) Think about the derivative as the slope of the original curve. By the way, you can download graph paper at our course website.

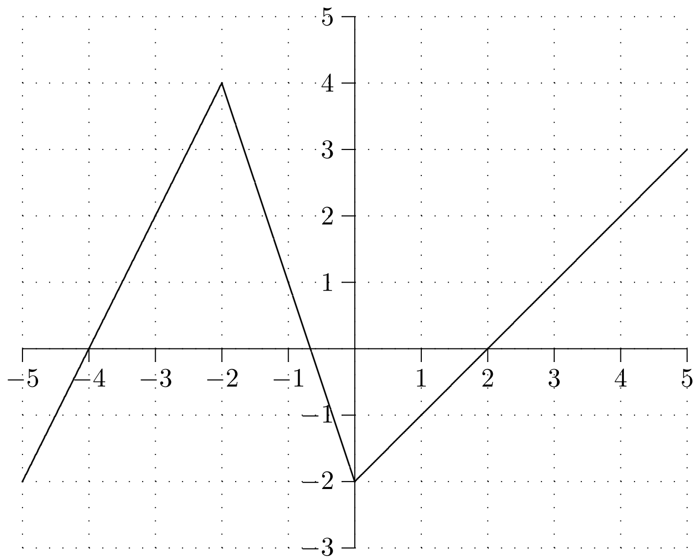
4. Page 142 #10. Recopy the graph. See Example 2. Your answer should have the correct shape, but will not be as accurate as in #6. (See the answer to #15.) Think about the derivative as the slope of the original curve.

5. Page 142 #16. Recopy the graph. Your answer should have the correct shape. (See the answer to #15.)

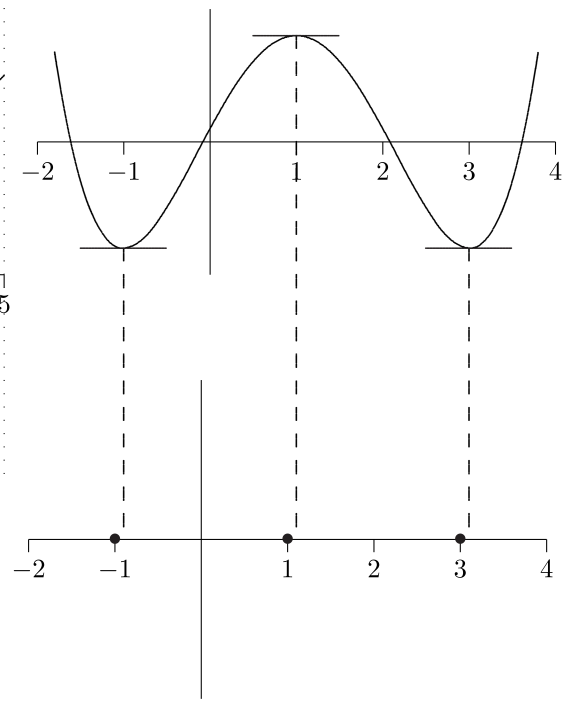
Derivatives from Graphs

Often in the 'real world' we have graphs of functions (from data that's been collected) but we do not have a formula for the function—sometimes no simple formula exists. Nonetheless from the graph of the original function we can often obtain a graph of the derivative by interpreting the derivative as the slope of the the original function. Let's start with a relatively easy example that will also introduce the idea points where a function is not differentiable.

Example. Graphical Differentiation Let $f(x)$ be the piecewise function shown in **black**.



$f'(x) = 0$ at -1, 1, and 3.



$\ldots$ so $f'(x) = 0$ at -1, 1, and 3.

Solution. Remember that the geometric meaning of the derivative is as the tangent slope. Using the figure, what is the slope of the section of the graph for $-5 < x < -2$? What at the slopes for the other sections? What is the slope right

Note: The slope of the tangent line changes abruptly at both $x = -2$ and $x = 0$. There are 'corners' in the graph at these two values. As a result, there is no single value of the slope that makes sense at each point. In other words, $f'(-2)$ and $f'(0)$ do not exist. The derivative is not continuous at these points.

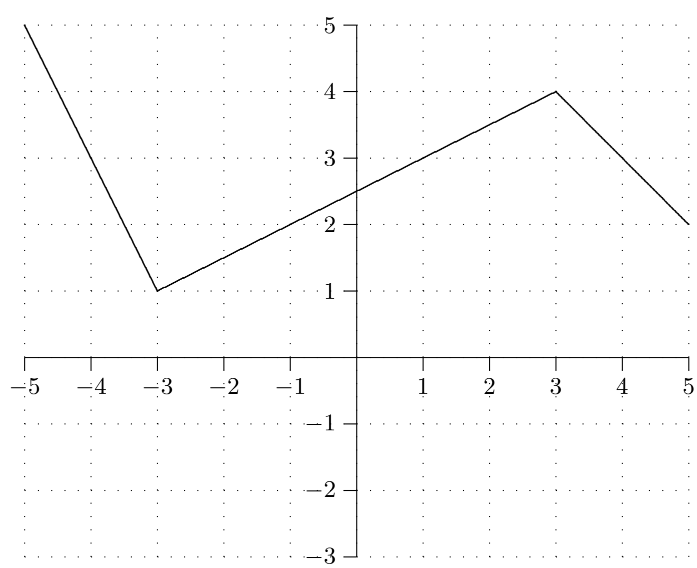
Example. Graphical Differentiation Sketch the graph of $f'(x)$ if $f(x)$ is the function shown in the upper half of the figure.

Lab Ticket: Complete and Bring to Lab. Name: ________________________

1. Use the definition to find the derivative of $f(x) = x^3$. [Be careful when you cube $x + h$.] Start with

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h\to 0} \frac{(x+h)^3 - x^3}{h}$$

2. [Graphical Differentiation] Let $f(x)$ be the piecewise function shown in the figure. On the same set of axes, plot the graph of $f'(x)$. Remember that the geometric meaning of $f'(x)$ is the tangent slope the tangent slope. So for each x between -5 and 5 plot the value of the slope of the original graph $f(x)$. Careful: Indicate where $f'(x)$ does not exist.



3. ☞ Bring a calculator to lab! Put it with your backpack now.