

Homework 2  
(due Friday, October 3)

We introduced the notation  $\frac{dy}{dx} = f'(x)$ . This makes it easy to see that the derivative has units

$$\frac{\text{units of } y}{\text{units of } x}.$$

We also saw that  $\left. \frac{dy}{dx} \right|_{x=a} = f'(a)$  is the derivative of the function evaluated at  $x = a$ .

**Example 0.1.** If  $f(x)$  gives the height (in feet) of the Mississippi River  $x$  miles from its source, then  $f'(x)$  has units  $\frac{\text{feet}}{\text{mile}}$ . If we say that  $f'(2) = 4$ , then we are saying that the instantaneous rate of change of  $f(x)$  at  $x = 2$  is 4. In practical terms we are simply saying

“when we are  $x = 3$  miles from the source we expect the Mississippi river to be 4 feet higher than the Mississippi river  $x = 2$  miles from the source. ”

1. Do the following problems from section 2.4

(a) Problem 2

(b) Problem 4

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The basic idea for section 2.5 is the following:

$$f(x) \text{ increasing} \iff f'(x) > 0$$

$$f(x) \text{ decreasing} \iff f'(x) < 0$$

$$f(x) \text{ concave up} \iff f'(x) \text{ is increasing} \iff f''(x) > 0$$

$$f(x) \text{ concave down} \iff f'(x) \text{ is decreasing} \iff f''(x) < 0$$

2. Do problem 32 from section 2.5

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3. In each part, sketch the graph of a function that satisfies the given property. If no such function exists, explain why.

(a) Continuous at  $x = 0$ , but not differentiable at  $x = 0$

(b) Differentiable at  $x = 0$ , but not continuous at  $x = 0$ .

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4. (Algebra Practice) Solve for  $w$  exactly:  $3(w + 1)^2 - 7 = 0$

5. (Algebra Practice) Solve for  $q$  exactly:  $\frac{2}{q} + q = 3$