

MATH 2250, Fall 2015 (Danny Krashen)
LECTURE FOR TUESDAY 9-3-2015

The students should have been introduced to the basic derivative rules, sum rule, constant multiple rule, product rule, quotient rule, power rule from chapter 3.3. They have not seen yet the chain rule or derivatives of exponential functions.

Lecture goal: cover derivatives of exponential and trigonometric functions. students should practice combining these with the derivative rules which they already have learned.

1. (15 minutes?) Reminder of Derivative Rules (Section 3.3)
 - i. Write the product rule, quotient rule and power rules on the board.
 - ii. Work out the derivative of $f(x) = x^7 + x^3 - 1$, $f(x) = x^3 - 4\sqrt[3]{x} - \frac{1}{x}$, and $f(x) = \frac{x^2 - 9}{\sqrt{x} + 1}$.

2. (20 minutes?) Exponential function and its derivative (section 3.3)
 - i. Use the definition of the derivative to work out for $f(x) = a^x$ that

$$f'(x) = a^x \left(\lim_{h \rightarrow 0} \frac{a^h - 1}{h} \right).$$

- ii. State that the number e is the unique number with the property that $\lim_{h \rightarrow 0} (e^h - 1)/h = 1$, and so $(e^x)' = e^x$.
 - iii. calculate $f'(x)$ for $f(x) = \frac{e^x + 1}{1 - x^2}$.
3. (20 minutes?) Derivative of trig functions (section 3.5)
 - i. Use the definition of the derivative, the sum formula to work out $(\sin x)' = \cos x$ (beginning of section 3.5). students have seen limits of $\sin x/x$ and $(\cos x - 1)/x$ as $x \rightarrow 0$.
 - ii. Show $(\cos x)' = -\sin x$. Feel free to skip details, as they have just seen the basic idea with sine.
 - iii. calculate $f'(x)$ for $f(x) = 5e^x + \cos x$, for $f(x) = \sin x \cos x$ and for $f(x) = \frac{\cos x}{1 - \sin x}$.

4. (20 minutes?) Group work.

With the time remaining (if any), tell the students to break up into groups and work on some practice problems like these (write them on the board, students know well how to break up into groups of about 2-4 students each and work on problems). They should calculate the derivatives of the following functions:

- i. $\tan x$
- ii. $\sec x$
- iii. $\csc x$
- iv. $\cot x$
- v. (if they finish the others with time to spare) $\left(\frac{3x - \tan x}{\sec x + \cos x} \right) e^x \sqrt{x}$