Math 130-01, Spring 2020 Information about the second test

The second test for this course will be given in class on Wednesday, March 11. The test will cover Chapter 3, except for Section 3.8. You should also be aware of prerequisite material about trigonmetric functions, inverse functions, exponentials, and logarithms.

A significant part of the test will be simply computing derivatives using all of the rules that have been covered in class. There will also be questions that test your understanding of derivatives and their meaning, such as understanding a derivative as a rate of change or as the slope of a tangent line. In addition to calculations, questions can include essay questions and definitions and possibly a simple proof using the definition of derivative.

You will not need a calculator for the test. *Although you will probably not need it, a basic non-graphing calculator will be provided to you, and you will be permitted to use only the calculator that is provided. Scrap paper will also be provided. All you need is a pencil.*

Here are some terms and ideas that you should be familiar with for the test:

the derivative of $f(x)$ as a function, $f'(x)$

how the graph of the derivative, $f'(x)$ relates to the graph of $f(x)$

derivatives as rates of change

velocity and acceleration

higher order derivatives: $f''(x), f'''(x), f^{(4)}(x), f^{(5)}(x), \ldots$

theorem: If $f'(a)$ exists, then $f(x)$ is continuous at $x = a$

derivatives of split functions; how to test differentiability at split points

the $\frac{d}{dx}$ notation for derivatives

rules for taking derivatives [see table below]

proofs of basic derivative rules, using the definition of derivative

finding an equation for a tangent line, using the derivative

the trigonometric functions

definition of $\sin(\theta)$ and $\cos(\theta)$ using the unit circle

other trig functions: $\tan(x) = \frac{\sin(x)}{\cos(x)}$, $\sec(x) = \frac{1}{\cos(x)}$

the basic identity $\sin^2(x) + \cos^2(x) = 1$

the chain rule

applying the chain rule using the formula $h'(x) = f'(g(x))g'(x)$

applying the chain rule using the $\frac{d}{dx}$ notation

inverse functions; $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$

how to tell whether a function has an inverse

restricting the domain of a function, to get a function that has an inverse

inverse function rule $(f^{-1})'(x) = \frac{1}{f'(f^{-1})(x)}$, and the proof of this formula

the inverse sine function $\sin^{-1}(x)$, defined for $-1 \leq x \leq 1$

the inverse tangent function $\tan^{-1}(x)$, defined for all x

the constant e, and the exponential function e^x

the natural logarithm function, $\ln(x)$, defined as the inverse of e^x

the basic inverse function identities for e^x and $\ln(x)$: $e^{\ln(x)} = x$ and $\ln(e^x) = x$

using the fact that $(f(x))^{g(x)} = e^{g(x)\ln(f(x))}$ to find $\frac{d}{dx}(f(x))^{g(x)}$

other exponential and logarithm functions: a^x and $\log_a(x)$ for any positive constant a

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Rules for derivatives that you should have memorized:

Constant Rule:	$\frac{d}{dx}c = 0$, for a **constant** c
Constant Multiple Rule:	$\frac{d}{dx}(c \cdot f(x)) = c \cdot \frac{d}{dx}f(x)$, for a **constant** c
Basic Rule:	$\frac{d}{dx}x = 1$
Power Rule:	$\frac{d}{dx}x^c = c \cdot x^{c-1}$, for a **constant** c
Sum Rule:	$\frac{d}{dx}(f(x) + g(x)) = \frac{d}{dx}(f(x)) + \frac{d}{dx}(g(x))$
Difference Rule:	$\frac{d}{dx}(f(x) - g(x)) = \frac{d}{dx}(f(x)) - \frac{d}{dx}(g(x))$
Product Rule:	$\frac{d}{dx}(f(x) \cdot g(x)) = f(x) \cdot \frac{d}{dx}(g(x)) + g(x) \cdot \frac{d}{dx}(f(x))$
Quotient rule:	$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x) \cdot \frac{d}{dx}(f(x)) - f(x) \cdot \frac{d}{dx}(g(x))}{(g(x))^2}$
Chain rule:	if $h(x) = f(g(x))$, then $h'(x) = f'(g(x))g'(x)$
Basic trig rules:	$\frac{d}{dx}\sin(x) = \cos(x)$ and $\frac{d}{dx}\cos(x) = -\sin(x)$
Inverse trig rules:	$\frac{d}{dx}\sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}}$ and $\frac{d}{dx}\tan^{-1}(x) = \frac{1}{1+x^2}$
Basic exponent/log rules:	$\frac{d}{dx}e^x = e^x$ and $\frac{d}{dx}\ln(x) = \frac{1}{x}$

If other derivative rules are needed on the test, they will be given to you on paper or written on the board.

You are also not responsible for trig identities, aside from $\sin^2(x) + \cos^2(x) = 1$, $\tan(x) = \frac{\sin(x)}{\cos(x)}$, and $\sec(x) = \frac{1}{\cos(x)}$. You might need to use basic rules of exponents and logarithms, which you should know from precalculus, but you will not be asked about them explicitely.