

Math 155G-22.

Topics for the final.

- Review all the tests, use them as guideline for what you need to study.
- Look at the WebWork problems.

I Limits: Sections 2.2, 2.3, 2.4, 2.5, 4.7

You have to be able to work out limits like

$$\lim_{x \rightarrow 0} \frac{\sin(4x)}{3x}, \quad \lim_{x \rightarrow 1} \frac{x-1}{x^2-1}, \quad \lim_{x \rightarrow 0} \frac{\cos(3x)-1}{\sin(2x)}$$

$$\lim_{x \rightarrow 0} x \ln(x), \quad \lim_{x \rightarrow \infty} x e^{-x},$$

$$\lim_{x \rightarrow \infty} \sqrt{x^2 + 2x - 1} - x.$$

2) What is L'Hôpital's Rule?

3) What does it mean that a function is continuous at a point  $x=a$ ?

## II Differentiation

- You will not be asked for the definition of the derivative or to find the derivative using the definition, but you should know what average change and instantaneous rate of change is (page 64).
- You need to know the derivative of standard functions
  - $x^k$ ,  $\ln(x)$ ,  $e^x$ ,  $\cos(x)$ ,  $\sin(x)$ ,  $\tan(x)$  (3.2, 3.6, 3.10)
  - You have to be able to use the product rule and quotient rule (3.3).
  - You have to be able to use the chain rule  $\frac{df}{dx} = \frac{df}{du} \frac{du}{dx}$ . (3.7)
  - You have to know how to find the equation of the tangent line through the point  $(a, f(a))$ : The slope is  $f'(a)$  and the equation is
 
$$y - f(a) = f'(a)(x - a).$$

- (4.1) →
- What has this to do with linear approximation?
  - You have to be able to find  $\frac{dy}{dx}$  and the equation of the tangent line even if  $y$  is only defined implicitly (3.8).

- The most important part of chapter 4 is
  - \* How to find min and max. You have to know the difference between absolute and local max/and min. (4.2)
  - \* Why do we have to test the endpoint extra?
- You will not be asked to draw a graph of a function BUT: YOU: HAVE TO KNOW:
  - \* How to find local max/min
  - \* What are the asymptotes
  - \* What is an inflection point
  - \* How do you find the interval(s) where a function is concave up/down.

There might be given a function with the first and second derivative and the question like

- ↔ Find the horizontal and vertical asymptote(s).
- ↔ Use interval notation to indicate where the function is concave upwards/downwards.
- ↔ Locate the inflection points  
[ ETC. ]

- There will be no questions from p. 213-214, 4.6, 4.8 5.1, <sup>5.5</sup>5.8, 6.5, 8.2, and 8.3.
- There will be no question involving Newton's method.

### III Integration

- There will be no questions about Riemann sums.
- You have to be able to find the antiderivative of standard functions like

$$+ x^k \quad (k \neq -1)$$

$$+ \frac{1}{x}$$

$$+ e^x$$

$$+ \cos(x), \sin(x), \cosh(x), \sinh(x)$$

+ Very important: Substitution 5.6

$$+ \int \frac{dx}{1+x^2} = ? \quad \int \frac{dx}{\sqrt{1-x^2}} = ?$$

+ Make sure not to differentiate if you are asked for antiderivative (and the other way if you are asked to find the derivative).

- What is the difference between finding the antiderivative  $\int f(x)dx$  and evaluating the definite integral  $\int_a^b f(x)dx$ ?
- What is the fundamental theorem of calculus?

IV: Finally: All the material for test 4 and 8.1.