Math 1210-3
Wednesday Jan 30

§1.3 Limit theorems
+
review for exam

Review Sessions:
tonight 7-8:30 p.m. JWB 335 Prof K.
Thurs 9:40-10:30 am " Ms. Kitchen

Exercise 1 Review theorem A from Tuesday notes.
Try to prove A.4 with $\varepsilon-\delta$ def.

Exercise 2 Use Theorem A to compute the following limits, step by step.

2a) $\lim_{x \to -1} 3x^2 + x$

2b) $\lim_{x \to 3} \frac{\sqrt{x^2+9}}{x}$

2c) $\lim_{x \to 2} \frac{x^3 - 8}{x^2-4}$ Careful!

Use Theorem C If $f(x) = g(x)$ for all x in an open interval containing c, except possibly at c itself, and if $\lim_{x \to c} g(x)$ exists, then $\lim_{x \to c} f(x)$ exists too, with the same limit.

recall, a <u>polynomial function</u> f has the form $f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$

a <u>rational function</u> f is a quotient of two polynomials,

$$f(x) = \frac{a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0}{b_m x^m + b_{m-1} x^{m-1} + \cdots + b_1 x + b_0}$$

<u>Theorem B</u> <u>Substitution Theorem</u> for rational functions

If f is a polynomial or rational function, then

$$\lim_{x \to c} f(x) = f(c),$$

provided $f(c)$ is defined. For a rational function this means the denominator is non-zero for $x = c$.

<u>Exercise 3</u> $\lim_{x \to -2} \dfrac{x^3 + 8x^2 - 7}{x^2 + 4} =$

<u>Exercise 4</u> $\lim_{x \to 2} \dfrac{x^2 + 3x - 10}{x^2 + x - 6} =$

Exam 1 Review Sheet

Resources:
Text(s)
Class notes
Webworks 1–3
Problems and VIP problems
Friday quizzes
Practice tests

Exam covers P.1–P.5
0.4–0.7
1.1–1.3

Study advice: organize your thinking by concepts. Exam questions are designed to test your understanding. The purpose of homework/sample problems is to help you learn (and test your understanding and ability to use) the key ideas.

Concepts

P.1–P.5 : Polynomial calculus

- lines
  - slope
  - equations for lines : pt-slope, slope-intercept, general form
  - $\perp$ lines, $\parallel$ lines,
  - distance between points, from points to lines
- derivatives
  - secant line slope / average velocity / average rate of change
  - limit def. of derivative
    - slope of graph ; tangent line to graph
    - (instantaneous) velocity } units!
    - (instantaneous) rate of change }
    - using the limit definition to compute polynomial derivatives
  - derivative rules for polynomials
  - deducing derivative or rate of change information from graphical data
- antiderivatives and integrals
  - working backwards from accel or vel. to position
  - antidifferentiation rules for polynomials
  - FTC, application to area, net and total distance

0.4–0.7 Equations, functions, graphs

- graph of an equation
  - graph of a function
  - how to change the equation to translate, scale, or reflect the graph
- functions
  - domain, range,
  - graph
  - trig functions, esp sin, cos
    - trig identities : the three to memorize
    - trig function values at "elementary" angles

1.1–1.3 Limits

- computing limits : substitution; algebra tricks to first eliminate $\frac{0}{0}$ problem.
- precise ε-δ limit def.
  - error estimation problems : If you are given error bounds for "x", find error bounds for $f(x)$.
- limit theorems, to justify computing limits by substitution.