Study Guide for Q1 Midterm AP Calculus AB 2015-16

- 25 questions, 4 pts each
- Some multiple choice, some free response; Some non-calculator, some calculator

Standards Assessed on Midterm:

F-LF1: Calculate limits (including limits at infinity) using algebra.

- Using properties of limits: see chart on pg. 59 (sample: p. 91#29-32)
- Using direct substitution
- Using factor and cancel ("massage the limit")
- Using rationalization
- Using trig substitution: some variation of $\sin^2 x + \cos^2 x = 1$ (ex: #4c on p.AP1-1)
- Using special trig limits: ("tattoos") see pg. 65
- P. 91-2: #13-22, 73-77

F-LF2a: Estimate limits of functions (including one-sided limits) from graphs or tables of data.

- Generic graph with letters on axes; finding limits from a graph
- Generic graph on coordinate plane: p. 56 #23 and 24, p 58 #66

F-BF1: Describe asymptotic behavior (analytically and graphically) in terms of infinite limits and limits at infinity.

- Be able to solve/identify problems by working in both directions:
  - "horizontal asymptote" ⇔ $\lim_{x\to\infty} f(x) = b \;\; for\ b \in \mathbb{R}$ $(use\ degree\ rules\ to\ find\ b; p\ 198)$
  - "vertical asymptote" ⇔ $\lim_{x\to c} f(x) = \infty \;\; for\ c \in \mathbb{R}$ (plug in one-sided values to get $1/0^+$ or $1/0^-$ which then leads to $\pm\infty$)
  - Sample problems: p 202 #13-26 p 88 #5-8, 17-20, 33-38

F-BF2: Discuss the various types of end behavior of functions; identify prototypical functions for each type of end behavior.

- Relative magnitude of functions: exponentials most dominant (higher bases), polynomials (higher degrees), logarithmic functions least dominant
- Even degrees: u shaped; odd degrees: kinda s-shaped; positive and negative leading coeff. reflect over x-axis
- Sample problem: Explain why $\lim_{x\to\infty} \frac{x^{500}}{e^x} = 0$

F-LF2b: Apply the definition of a limit to a variety of functions, including piecewise functions.

- Find $\lim_{x \to \pi} f(x)\ for\ f(x) = \begin{cases} \sin(x) & ,x < \pi \\ x^2 & ,x = \pi \\ \cos(x) + 1, & x > \pi \end{cases}$
- pg 80 #51-55
- p. 92 61-62

F-C1: Define continuity at a point using limits; define continuous functions.
F-C2: Determine whether a given function is continuous at a specific point.

- Know the three things that must be true for a function to be continuous at a point.
- *Demonstrate* that $\lim_{x \to c-} f(x) = f(x) = \lim_{x \to c+} f(x)$ for a given f(x)
- P. 80 #83, 84 p. 92 #84

F-C3: Determine and define different types of discontinuity (point, jump, infinite) in terms of limits.

- Jump : $\lim_{x \to c-} f(x) = d\ and\ \lim_{x \to c+} f(x) = e$ where d and e $\epsilon \mathbb{R}\ but\ d \neq e$ f(c) may equal either d or e or neither or be undefined. (usually a piecewise function)
- Removable: $\lim_{x \to c} f(x) = b\ for\ b\ \epsilon\ \mathbb{R},\ but\ f(c) \neq b$ (usually a cancellation of a rational function, or a piecewise where the cases are x=c and x$\neq c$)
- Infinite: (same as vertical asymptote) either $\lim_{x \to c+} f(x) = \pm\infty\ \ or\ \lim_{x \to c+} f(x) = \pm\infty$ (usually where denominator has a term that cannot be canceled out)

-p80: #43-48 p. 92 #49-56 p. 92 #68-70

F-C4: Apply the Intermediate Value Theorem and Extreme Value Theorem to continuous functions.

- Show/state that it is continuous on the interval in equation (hint: polynomial functions are always continuous everywhere)
- P. 92 #63