Mth133 – Calculus: Exam 1 Review

Note: This is not a complete list of topics – you should study your lecture notes and homework in addition to reviewing the items listed here.

1. prerequisite knowledge
    a. solving polynomial and rational equations
    b. solving polynomial and rational inequalities
    c. evaluating trigonometric functions

2. using the limit definition
    a. Given ε, find a δ, so that $|f(x)-L|<\varepsilon$ whenever $0<|x-c|<\delta$.

3. evaluating limits
    a. estimating numerically with a table of values
    b. estimating graphically
    c. calculating analytically
        i. If f is a polynomial, rational, root, or trigonometric function, and c is in the domain of f, $\lim_{x\to c} f(x)=f(c)$.
        ii. Squeeze Theorem
        If $g(x)\le f(x)\le h(x)$ and $\lim_{x\to c} g(x)=L=\lim_{x\to c} h(x)$, then $\lim_{x\to c} f(x)=L$.
        iii. $\lim_{x\to 0}\frac{\sin x}{x}=1$ and $\lim_{x\to 0}\frac{1-\cos x}{x}=0$

4. If $f(c)=\frac{0}{0}$, the limit is indeterminate, and other techniques are necessary.
    a. If f is a rational function, see if it can be factored.
    b. If f has a radical, try multiplying by the conjugate.
    c. If f is a complex fraction, simplify by multiplying the numerator and denominator by the LCD.

5. continuity
    A function f is continuous at c if and only if $\lim_{x\to c^-} f(x)=\lim_{x\to c^+} f(x)=f(c)$.
6. Intermediate Value Theorem

7. one-sided limits
    a. graphically
    b. "numerically" – Mentally considering a number slightly less than c if $x\to c^-$, or slightly greater than c if $x\to c^+$.

8. infinite limits
    a. If $f(c)=\frac{a}{0}$, where $a \neq 0$, $\lim_{x \to c} f(x)$ does not exist. More specifically, the limit is an infinite limit. You then must determine whether the limit is ∞ or $-\infty$.

9. derivatives
    a. know the definition
    $$f'(x)=\lim_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$$
    b. finding the equation of a tangent line

10. when does a function fail to be differentiable at a point?