Unit 1 Day 1-7 Limits and Continuity Test

Review Summary: What you need to know

Day 1 – You need to know how to Factor using the Crazy GCF

Day 3- You need to be able to find the limit as x approached a value or infinity given a graph

Day 4 – You need to be able to find the limit as x approaches a value algebraically

Methods

1. Substitution
2. Factor , Reduce then Substitute
    a. This is often used with Rational Functions
3. Simplify then substitute
    a. If the rational functions has a numerator or denominator in which terms can be multiplied then simplified Ex./ $\lim_{x \to 0} \frac{(5+x)^2 - 3(5+x) - 10}{x}$
    b. If the numerator or denominator are a rational expression, find a common denominator and simplify Ex./ $\lim_{x \to 2} \frac{\frac{1}{x} - \frac{1}{2}}{x-2}$
4. Rationalize the numerator or denominator then substitute
    a. If the function has a radical in the numerator or denominator rationalize it
5. Sign Analysis
    a. This is your last resort

Day 5 – You need to be able to find limits as x approaches $\pm\infty$ (Remember : $\lim_{x \to \pm\infty} \frac{1}{x^n}; n \in \mathbb{N} = 0$)

1. If it is a rational function divide all the terms by the highest power of the variable in the denominator or multiply the number and denominator by the reciprocal or the highest power of the variable in the denominator
2. If the numerator or denominator has a radcial function , factor out a GCF from under the root sign that you will be able to take the exact root of. (Hint: highest power of variable under the root). If the numerator or denominator is a rational expression take out a GCF of the highest power of it's variable

Remember: If $\begin{array}{l} x \to \infty, |x| or \sqrt{x^2} = +x \\ x \to -\infty, |x| or \sqrt{x^2} = -x \end{array}$

Day 6- 1. You need to be able to sketch a piecewise function or find the equation of one given its graph

3. You need to be able to find the limits of piecewise functions and absolute value functions
   a. Remember $\lim_{x \to a^+} |x+1| = \lim_{x \to a}(x+1)$
      $\lim_{x \to a^-} |x+1| = \lim_{x \to a} -(x+1)$

Day 7 – Identify and classify discontinuities given a graph or function's equation. Explain why they are continuous or discontinuous using the definition of a continuous function

- A function f(x) is considered to be continuous at a specific x value of "a" if all of the following conditions are satisfied:

1. $f(a)$ exists (Note: it is a real #)
2. $\lim_{x \to a} f(x)$ exists (Note: In order for a limit to exist $\lim_{x \to a^+} f(x) = \lim_{x \to a^-} f(x)$)

$$\lim_{x \to a} f(x) = f(a)$$

Types of Discontinuity

Infinite Discontinuity: Occurs at a asymptote which means f(a) does not exist and $\lim_{x \to a} f(x)$ Does Not Exist because $\lim_{x \to a^-} f(x) = \pm\infty \therefore DNE$ and $\lim_{x \to a^+} f(x) = \pm\infty \therefore DNE$

Removable Discontinuity: Occurs when the limit exists so $\lim_{x \to a^+} f(x) = \lim_{x \to a^-} f(x)$ but $\lim_{x \to a} f(x) \neq f(a)$

Jump Discontinuity: Occurs when the limit does not exist so $\lim_{x \to a^+} f(x) \neq \lim_{x \to a^-} f(x)$ but $f(a) = \lim_{x \to a^+}$ or $f(a) = \lim_{x \to a^-}$