

Limits and Continuity Cheat Sheet

- Ø The function may not be defined at C and the limit concept only gives information about approaching a point.
- Ø If the left limit ($\lim_{x \rightarrow C^-} f(x) = L_1$) and the right limit ($\lim_{x \rightarrow C^+} f(x) = L_2$) are equal, i.e. $L_1 = L_2$, we say the limit of $f(x)$ exists and is equal to $L = L_1 = L_2$ as x approaches C .
- Ø For limits in the form $\frac{zero}{zero}$ the factor that is causing the numerator and denominator going to zero has to be cancelled out. Factoring is the way to go.
- Ø For limits including square roots, multiplication by numerator's or denominator's conjugate is usually a good idea.
- Ø For limits in the form of $\lim_{x \rightarrow +\infty} \frac{f(x)}{g(x)}$ or $\lim_{x \rightarrow -\infty} \frac{f(x)}{g(x)}$ factor the highest order term in the numerator and denominator separately. Then treat any item with denominator of x or x^2 or x^3 or etc as zero.
- Ø For limits at infinity that include square roots, only if the infinities are cancelling out by subtraction (to make the outcome zero), multiplication by numerator's or denominator's conjugate is a good idea. Otherwise, just factor the greatest exponent.
- Ø Calculus Captain Useful Identities:

$$(x - a)(x + a) = x^2 - a^2$$

$$(x - a)(x^2 + ax + a^2) = x^3 - a^3$$

$$(x + a)(x^2 - ax + a^2) = x^3 + a^3$$

$$(x - 1)(x^{n-1} + x^{n-2} + \dots + 1) = x^n - 1$$

- Ø A function $f(x)$ is continuous if at any point $x = a$, the $\lim_{x \rightarrow a} f(x)$ exists [which means $\lim_{x \rightarrow a^+} f(x) = \lim_{x \rightarrow a^-} f(x)$] and is equal to $f(a)$.