Calculating Basic Limits

A limit is the value a function would have if the function existed at the desired input value. We say that the function approaches some value as the input approaches some value.

Basic Limits

Sometimes we have to do a little algebra to calculate the limit. There are two types of calculations you will likely see in first-year calculus.

Rational *has factoring*	**Conjugate** *has square roots*
These types of calculations occur when the limit we are taking results in the denominator of the function becoming zero. **For Example:** $\lim_{x\to -2} \frac{x^2+x-2}{x+2}$ If we input $x=-2$ into the equation, we end up with 0 in the denominator. Since we cannot divide by zero we will first have to factor the numerator. $= \lim_{x\to -2} \frac{(x+2)(x-1)}{x+2}$ Now, we can cross out the $(x+2)$ factors in the numerator and denominator. $= \lim_{x\to -2} \frac{\cancel{(x+2)}(x-1)}{\cancel{x+2}}$ $= \lim_{x\to -2} x-1$ We've eliminated the divide by zero problem so we can now take the limit by plugging in $x=-2$. $=-2-1=-3$ Therefore: $\lim_{x\to -2} \frac{x^2+x-2}{x+2} = -3$	These types of calculations occur when the limit we are taking results in a divide by zero situation and the function has a square root. **For Example:** $\lim_{x\to -2} \frac{\sqrt{x+3}-1}{x+2}$ If we input $x=-2$ into the equation, we end up with 0 in the denominator. Since we cannot divide by zero and we cannot factor we will have to multiply by the conjugate of the binomial containing the square root. A conjugate is when we change the sign between two terms. $(a+b)$ and $(a-b)$ are conjugates. $\lim_{x\to -2} \frac{\sqrt{x+3}-1}{x+2} \times \frac{\sqrt{x+3}+1}{\sqrt{x+3}+1}$ FOIL the numerator $= \lim_{x\to -2} \frac{\left(\sqrt{x+3}\right)^{\cancel{2}}-1}{(x+2)\left(\sqrt{x+3}+1\right)}$ Don't FOIL the denominator $= \lim_{x\to -2} \frac{x+3-1}{(x+2)\left(\sqrt{x+3}+1\right)}$ $= \lim_{x\to -2} \frac{\cancel{x+2}}{\cancel{(x+2)}\left(\sqrt{x+3}+1\right)}$ Cancel the factors $= \lim_{x\to -2} \frac{1}{\sqrt{x+3}+1}$ $= \frac{1}{\sqrt{-2+3}+1} = \frac{1}{2}$ Take the limit Therefore: $\lim_{x\to -2} \frac{\sqrt{x+3}-1}{x+2} = \frac{1}{2}$

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