Continuity

Some Common Discontinuities

If there's no reason for a function to have a discontinuity, it is likely continuous. Below are some of the more common discontinuities.

- Negative values inside even numbered roots.
- Vertical asymptotes
- Removable discontinuities
- Piecewise discontinuities.

Some Functions That are Continuous Everywhere

Functions that are continuous everywhere can be relied upon to behave predictably, so it's good to be familiar with them. In particular, finding limits of continuous functions is very easy, because you can just plug the x-value being approached into the function.

Here are some of the most common functions that are continuous everywhere:

- Polynomials
- Exponential Functions
- Some trigonometric functions (sinx and cosx, and basic combinations of them)
- Rational functions with no real zeroes in the denominator

Continuity Problem Solving Tips

- Try to recognize the function as one that is continuous everywhere, or one that has discontinuities.
- If the function has discontinuities, what kind are they? Are they undefined values, vertical asymptotes, or removable discontinuities?
- To determine whether a piecewise function is continuous everywhere, first decide whether the individual equations are continuous over their domains. Then plug each transition value into the equations surrounding them. If the two functions on either side have equal values, then the piecewise function is continuous there too.

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Limits at Vertical Asymptotes

If you determine there is a vertical asymptote at the value x is approaching, follow these steps to find the limit:

- Pick numbers a little less and a little more than the value x is approaching (such as within 0.01)
- Plug these numbers into the function. You should get large positive or negative values.
- If both values are large positive numbers, the limit is ∞.
- If both values are large negative numbers, the limit is $-\infty$.
- If one value is positive and one value is negative, the limit does not exist.