

Discontinuity

A discontinuity, according to the Merriam-Webster dictionary, is a point at which a function is discontinuous or undefined. All of the important functions used in calculus are continuous EXCEPT at isolated points, let them be points of discontinuity.



Types of Discontinuity

Jump Discontinuities
Infinite Discontinuities
Removable Discontinuities
Endpoint Discontinuities



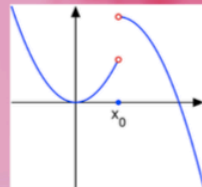
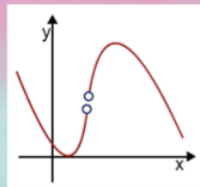
Jump Discontinuity

Also known as simple / discontinuities of the first kind, occur where the function approaches two different values from either side of the discontinuity. Normally, simple discontinuities include piecewise functions which in both the limits exist but are not equal. The size of the jump is the difference between the right (+) and left (-) hand limits. Basically is to define a function in specific regions.

In the Jump discontinuity the functions change for approaching different values at x_0 but in the same value



In the Jump discontinuities the functions characterize for approaching to 2 different values at the y axis, but in the same value at x.

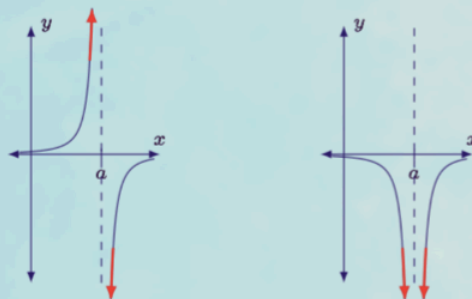


Infinite Discontinuity

Infinite discontinuities can be shown when one of the one-sided limits exist (it may be as $+$ or $- \infty$). The majority of rational functions exhibit this type of discontinuity, showing a vertical asymptote at the value of x .



This are rational functions with a infinite discontinuity. his happens because as shown, they have vertical asymptotes, with part of the function in each of the sides.



Other Examples of Infinite Discontinuities



Removal Discontinuity

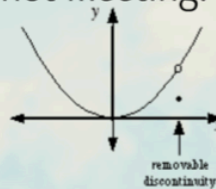
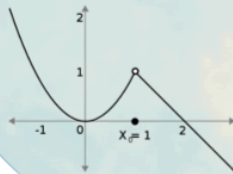
Exists when the limit of the function exists but either one or two conditions are not met, meaning that a hole is present. It may be whether the value is undefined, or a function which has a limit and a value at that point of its graph. Basically, functions that are defined differently for a certain point.



A removal discontinuity as we can see has a limit, but as presented in this examples there is a hole outside of the function. This means that both equations are not meeting.



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Endpoint Discontinuity

Whenever a function is defined on an interval with a closed endpoint (including the value), the limits does not exist because there's no graph coming from one side.



This graph shows how the discontinuity is defined in a close dot, this means that the limit will not exist. As we can see in the examples the function only comes from one side.

