Continuity

A function is *discontinuous* at some x value if:
1) The x value makes the function undefined.
2) The graph is disconnected, has a vertical asymptote, or open circle at the x value.

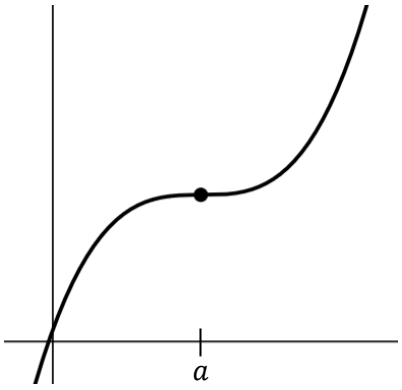
Three conditions are required for a function to be *continuous* at some number a:

1) $f(a)$ is defined

2) $\lim_{x \to a} f(x)$ exists

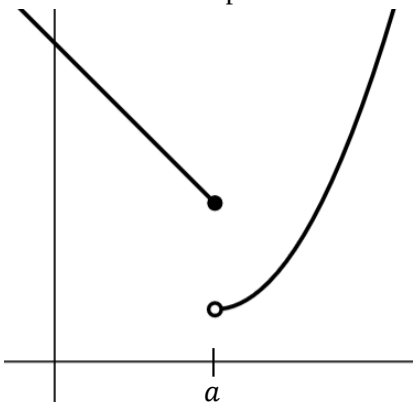
3) $\lim_{x \to a} f(x) = f(a)$

All 3 conditions must be met
for the function to be continuous at $x = a$.

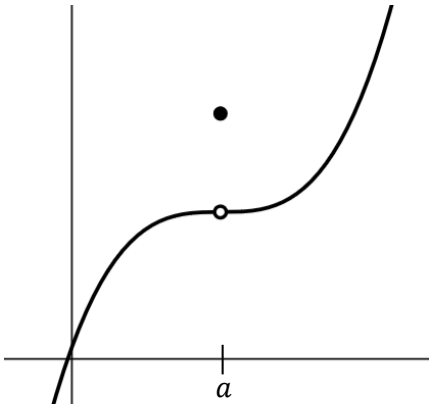


Types of Discontinuities

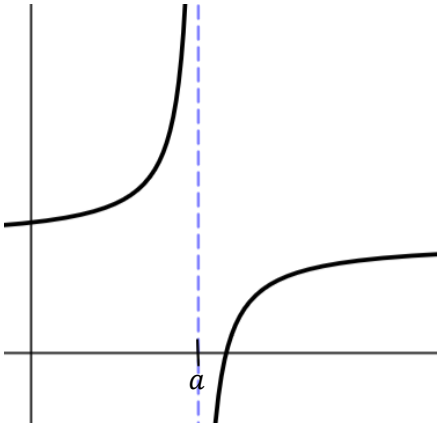
Jump



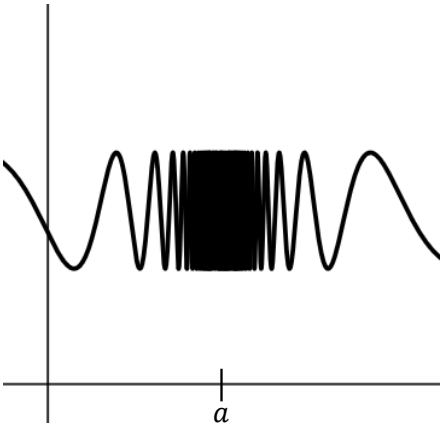
Removable



Infinite



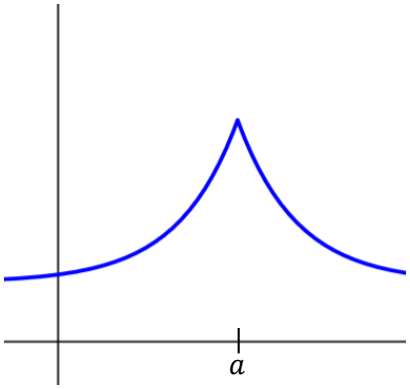
Oscillating



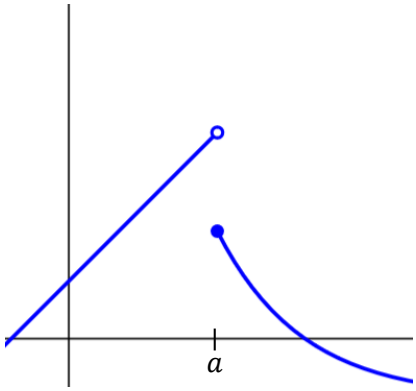
Differentiation

3 ways a function is not differentiable:

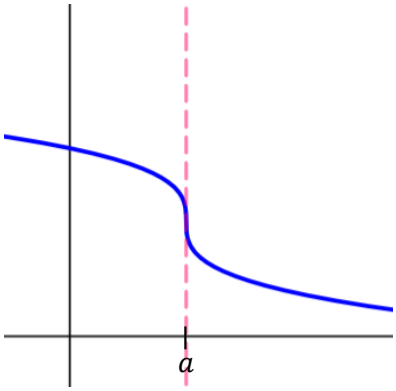
1) a corner



2) discontinuity



3) vertical tangent



Derivative Notation

There are several notations for derivative, which all mean the same thing:

$f'(x)$ (f prime of x)

f' (f prime)

y' (y prime)

$\frac{dy}{dx}$ (derivative of y in terms of x) (dy, dx)

For dy/dx notation, the y can be replaced by whatever function you are finding the derivative of.

Example: For the function $f(x) = x^2 + 3x$ the derivative is $f'(x) = 2x + 3$

In $\frac{dy}{dx}$ notation, the derivative can be shown as: $\frac{d(x^2 + 3x)}{dx} = 2x + 3$ or $\frac{d}{dx}(x^2 + 3x) = 2x + 3$

which is saying, the derivative of $x^2 + 3x$ in terms of x is equal to $2x + 3$.

The derivative could also be shown as: $\frac{dy}{dx} = 2x + 3$