Chain Rule Encyclopedia Article

Chain Rule

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Chain Rule

The chain rule is a method of differentiating a function which is composed of two nested **functions**. That is, the chain rule provides a general case for taking the x derivative of a function f(g(x)). The chain rule states that the derivative of such a nested function is the product of the derivatives of each function, evaluated at appropriate points. That is, the derivative of such a function is the derivative of f, assuming that g is itself the **variable**, multiplied by the derivative of g, assuming that x is the variable.

For example, the function $\sin(x^2)$ can be evaluated using the chain rule. The derivative of sin(y) is cos(y), and the derivative of x^2 is 2x. Therefore, the derivative of $\sin(x^2)$ is $2x\cos(x^2)$. The term that is particularly of interest is the argument of the **cosine** term. The only trick to the chain rule is remembering that the original argument of the outer function must be the argument of its derivative as well.

The chain rule is one of the basic rules of differentiation. It would be possible to step through the limit **definition** of a derivative every time a composite or nested function came up, but the chain rule provides a much more efficient method and is widely used wherever **calculus** is applied.