Introduction:

For this assignment, we must write three definitions of a term we choose: parenthetical definition, sentence definition, and expanded definition. The objective of this assignment is for students to be able to differentiate between different types of definitions, as well as knowing the proper use of them given different type of situation and different audience.

I will be using the term: Calculus. The audience are mostly high-school students or university students with some pre-calculus background but have not taken the actual calculus class yet, thus are still unaware of the term. The objective is to give the audience a little bit of overview of what is meant by calculus and some exposure to the theory used in the field.

Parenthetical definition:

Calculus (a method of calculating continuous change) is an advanced branch of mathematics.

Sentence Definition:

Calculus is a branch of mathematics that deals with calculation of continuous change by working with infinitely small numbers.

Expanded Definition:

Etymology

Calculus is a branch of mathematics that deals with calculation of continuous change. The word calculus origins from Latin word, calculus, which means "small pebbles used for counting on an abacus" ("Calculus"). Although there are other fields in mathematics such as vector calculus, matrix calculus, calculus of variations, and more; in general calculus is often referred as integral and differential calculus.

History

The idea of calculus had been developed in several countries, but it was popularized in the 17th century by Isaac Newton and Gottfried Wilhem Leibniz. Calculus's development was put into three periods of "Anticipation, Development, and Rigorization", that spanned for over 200 years (before 1600s to 1800s). In Development period, both Newton and Leibniz created the foundations of Calculus using "infinitesimals" (infinitely small but non-zero quantities) technique. Due to its rigorous and non-logical nature, in later century Cauchy, Weierstrass, and Riemann reformulated infinitesimals into "limits" (quantities close to others). This reformation eventually led a revolution on logical standing of Calculus as a foundation to modern Calculus ("calchistory").

Fundamental of Calculus - Differential Calculus

Differential calculus is the study of derivative of a function. The process of finding the derivative is called differentiation. The idea of differentiation is to measure the rate of change of a function, where you measure the change in the response variable over the change in the explanatory variable. For simple function, such as linear, the rate of change is often defined as slope, and can be calculated in simple steps because the rate of change of a linear is constant.

$$\frac{dy}{dx} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Equation 1. The differentiation of linear function

However, for more complicated functions, such as quadratic or exponential function, differentiation process involves small measurement by taking limits approaching the arbitrary point because the rate of change at every point is different.

$$\frac{dy}{dx} = \lim_{x \to a} \frac{f(x) - f(a)}{x - a} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Equation 2. The differentiation of functions other than linear

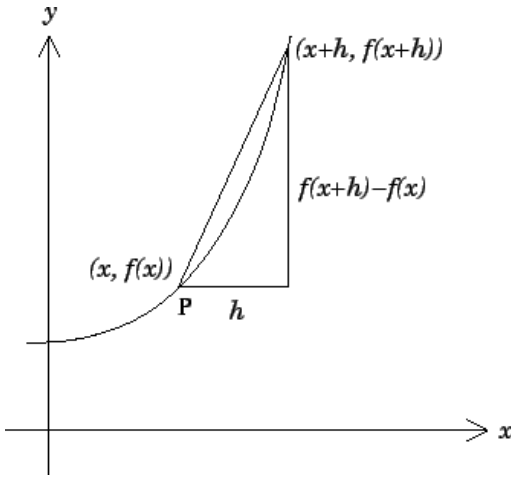

Figure 1. The illustration of derivative

The notation commonly used in differential calculus is d , which means “a little bit of” (Thompson, 1).

Application of Differential Calculus

Differential calculus is often used to measure slope, velocity and acceleration of an moving object, as well as optimization, for example to maximize or minimize profit in finance.

Fundamental of Calculus - Integral Calculus

Integral calculus is the study of integration of a function. Unlike differential calculus, integral calculus uses method of integration or anti-derivative to calculate the area under the function. The idea of integration is to divide the area under graph into many rectangles of different dimensions and sum them. To avoid overestimation or underestimation of the area calculation, the width of the rectangles is minimized into a very small, but non-zero value, while the length is the corresponding y-value.

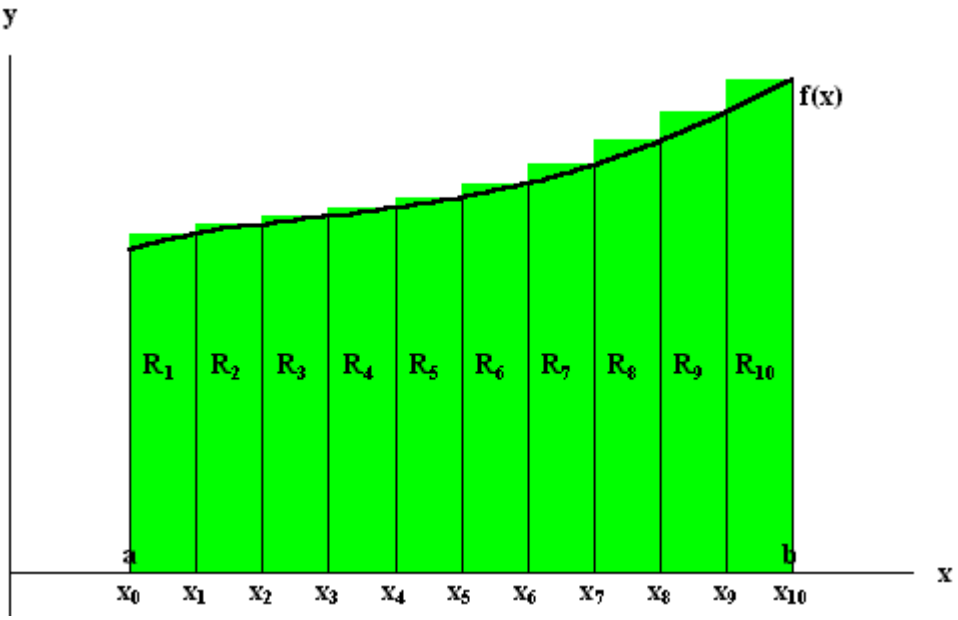

Figure 2. The illustration of integration

The notation commonly used in integral calculus is $\int$, which means "the sum of" (Thompson, 1).

Application of Differential Calculus

Integral calculus is often used in calculating area, volume, and arc length of a function, as well as center of mass, work, and pressure of a system. It's also widely used in computing probability, power series, and Fourier series.

References:

"Calculus".*Wikipedia*,n.d. https://en.wikipedia.org/wiki/Calculus. Accessed May 31st 2017.

"calchistory". *The History of Calculus*, Department of Mathematics of University of Houston, n.d.https://www.math.uh.edu/~tomforde/calchistory.html .Accessed May 31st 2017.

Thompson, Silvanus P. *Calculus Made Easy*. 2nd edition. New York: The Macmillan Company, 1914. Print.

Image Sources:

Figure 1: http://www.pgtc2007.org/maths/calculus/node2.html

Figure 2: http://www.sosmath.com/calculus/integ/integ01/integ01.html