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Math 31A Lecture Notes

Definitions:

**Differential Calculus** – the study of the change of rate over time.

**Integral Calculus** – the study of the total change of rate over time.

Example 1: How do we measure velocity?

OR *Speedometer* = *Instantaneous Velocity*

Question: Let f(x) be a function, what is the rate of change of the function x2?

Solution 1: Let there be two points (x0, x1) that lies on the f(x). The average rate of change of f(x) in the interval [x0, x1] is equivalent to: . This expression is also equivalent to the slope of the line passing through the points (x0, f(x0)), (x1, f(x1)), which is a secant line.

Solution 2: To calculate the instantaneous rate of change (the derivative or the tangent line), the same formula in Solution 1 must be used. However, x1 must approach x0 which is the limit. Hence, we achieve the formula: .

\*Note: Using the formula is not feasible since the limit of the expression as x0 approaches x0 is equivalent to . Hence, the pseudo-answer in this scenario is 0.