# Section 4.4: The Mean Value Theorem

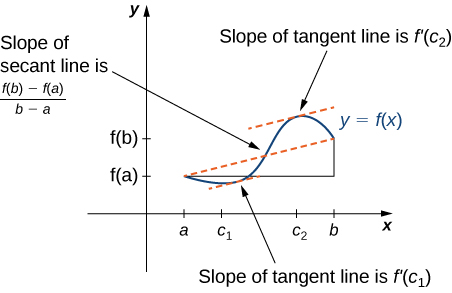
The Mean Value Theorem is one of the most important theorems in calculus. The Mean Value Theorem says that for a function that meets its conditions, at some point the tangent line has the same slope as the secant line between the ends. For this function, there are two values and such that the tangent line to at and has the same slope as the secant line.

## The Mean Value Theorem and Its Meaning

**Mean Value Theorem**

Let be continuous over the closed interval and differentiable over the open interval . Then, there exists at least one point such that

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Media: Watch this [video](https://youtu.be/o_9waQrwPes) example on the Mean Value Theorem of a quadratic function.

Media: Watch this [video](https://youtu.be/VF_vgEC1G6o) example on the Mean Value Theorem of a rational function.

Examples

1. For over the interval , show that satisfies the hypothesis of the Mean Value Theorem, and therefore there exists at least one value such that is equal to the slope of the line connecting and . Find the values guaranteed by the Mean Value Theorem.
2. If a rock is dropped from a height of , its position seconds after it is dropped until it hits the ground is given by the function .
   1. Determine how long it takes before the rock hits the ground.
   2. Find the average velocity of the rock for when the rock is released, and the rock hits the ground.
   3. Find the time guaranteed by the Mean Value Theorem when the instantaneous velocity of the rock is .