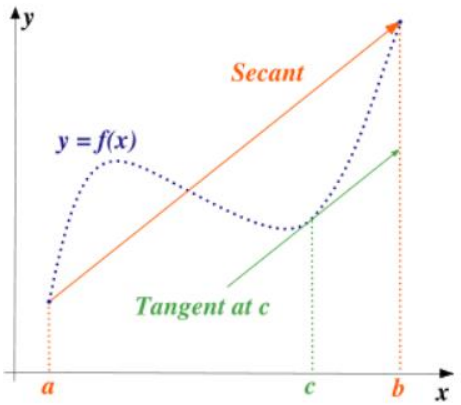
3.2 Rolle's Theorem and the Mean Value Theorem (MVT)

Obj: Define and Apply the MVT and Rolle's theorem

MVT for derivatives:
If *f(x)* is _____ along the closed interval [a, b] and _____ along the open interval (a,b) there exists at least one point c in (a,b) such that



Ex 1. Apply the MVT to $f(x)=x^3-2x$ on the interval [0,3]. Find all values within the interval.

Now Try: $f(x)=\frac{x+1}{x}$, $[\frac{1}{2},2]$ ..... Can you use the interval [-1,1]?

Why wouldn't the MVT apply to $f(x)=|x^2-4x|, [-1,2]$

Ex 2. Suppose a driver enters a tollway at mile marker 110, picking up a card at the toll plaza, and exits the tollway via the toll plaza at mile marker 215 just 1 hour and 16 minutes later. The toll booth attendant collects the $4.50 toll and issues a speeding ticket. How does the MVT tell us that the driver was speeding?

Rolle's theorem:

Let f(x) be _____on the closed interval [a,b] and _____ on the open interval (a,b). If *f(a)=f(b)*, then there is at least one number c such that:

3 criteria for Rolle's:

In Rolle's theorem (the MVT), the average slope is 0, so we can conclude a Horizontal tangent!

Given $f(x)=x^4-2x^2$. Find all the values of c in the interval (-2,2) such that f'(c)=0.

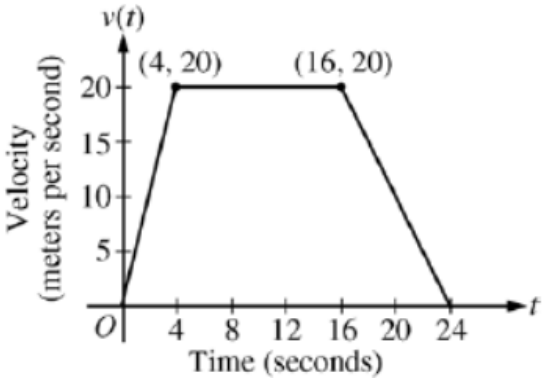
Sample AP Problems.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	6	4	2	5
2	9	2	3	1
3	10	−4	4	2
4	−1	3	6	7

The functions f and g are differentiable for all real numbers, and g is strictly increasing. The table above gives values of the functions and their first derivatives at selected values of x. The function h is given by $h(x) = f(g(x)) - 6$.

(a) Explain why there must be a value r for $1 < r < 3$ such that $h(r) = -5$.

(b) Explain why there must be a value c for $1 < c < 3$ such that $h'(c) = -5$.



Review: Approximate Acceleration at t=2.

When is the particle speeding up?

When is the particle stopped?

(d) Find the average rate of change of v over the interval $8 \le t \le 20$. Does the Mean Value Theorem guarantee a value of c, for $8 < c < 20$, such that $v'(c)$ is equal to this average rate of change? Why or why not?