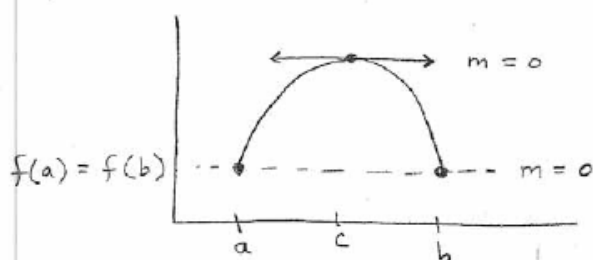


## 4.2 Mean Value Theorem and Rolle's Theorem

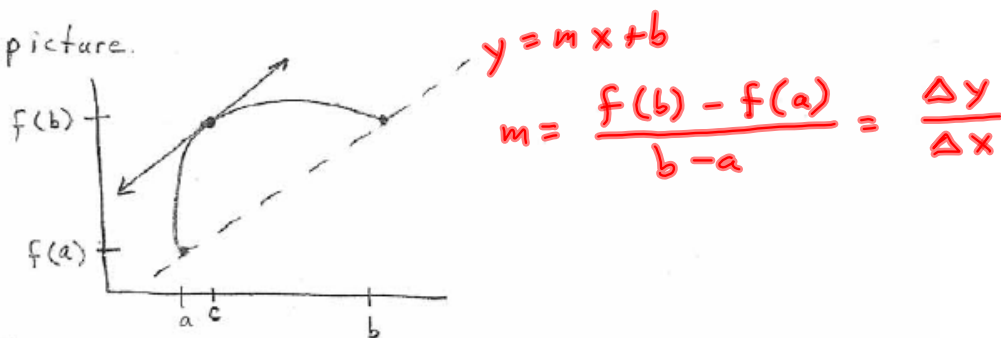
Rolle's Theorem: If  $f(x)$  is continuous on  $[a, b]$ , differentiable on  $(a, b)$ , and  $f(a) = f(b)$  then there exists  $c$  in  $(a, b)$  so that  $f'(c) = 0$ .

Proof by picture



Mean-Value Theorem: If  $f(x)$  is continuous on  $[a, b]$ , differentiable on  $(a, b)$  then there exists  $c$  in  $(a, b)$  so that  $f'(c) = \frac{f(b) - f(a)}{b - a}$ .

Proof by picture.



there's a value within the domain where the instantaneous rate of change is equal to the average rate of change.

# Pennsylvania Turnpike

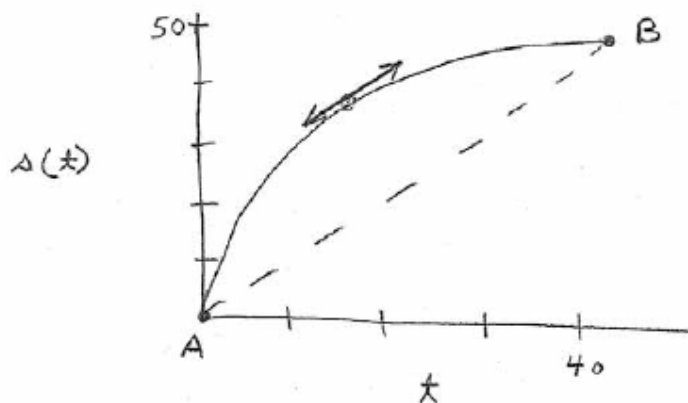
Speed
60
Limit

At checkpoint A, car is going 50 mph

At checkpoint B, car is going 55 mph

Checkpoints are 50 miles apart and car gets to B in 40 minutes.

Should driver get a ticket?



$$\frac{s(40) - s(0)}{40 - 0} = \frac{50 - 0}{40} = \frac{5}{4} \text{ mi/min}$$

$$\frac{5 \text{ mile}}{4 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = 75 \text{ mph}$$