Rolle's Theorem Using Mean value theorem

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Abstract

The mean value theorem is very important theorem in calculus which can be used in many practical applications,

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1. **Introduction** :
   The main objective of mean value theorem is under the specified hypotheses there is a point in the interval of intersect such that the slope of the tangent line at that point is equal to the slope of the sceant line connecting the two end points of the graph of the function

Let Y = F(x) be a function continuous in the closed interval [α, β] i.e ., $\alpha \leq$ c $\leq \beta$

$\lim_{x \to c} F(x)$ = F(c) and $\lim_{x \to \alpha^{+0}} F(x)$ = F(α), $\lim_{x \to \beta^{-0}} F(x)$ = F(β).

Let Y=F(x) be the differ in the closed interval [α, β] this means that if $\alpha \leq$ c $\leq \beta$ the derivative of F(x) at x=c exists

i.e., $\lim_{x \to c} \frac{F(x)-F(c)}{x-c}$ exists

then $\lim_{x \to \alpha^{+0}} \frac{F(x)-F(\alpha)}{x-\alpha}$ and $\lim_{x \to \beta^{-0}} \frac{F(x)-F(\beta)}{x-\beta}$ exists

Geometrically if F(x) is continuos function in the closed interval [α, β] , the graph of Y= F(x) is a continuos curve for the points x in [α, β] .

If F(x) is derivable in closed [α, β] ,these exists a unique tangent to the curve at every point in the interval [α, β] .

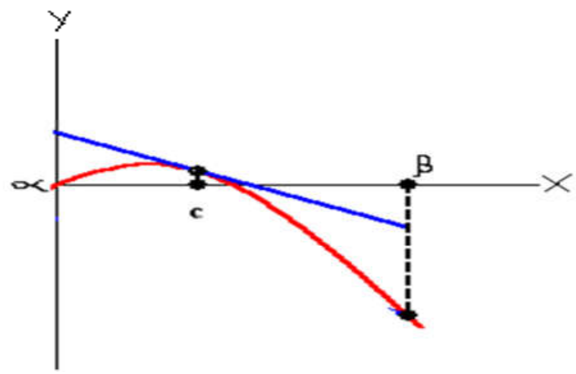


Figure 1

If f'(c) is positive it means that f(x) is an increasing function as x increases via c

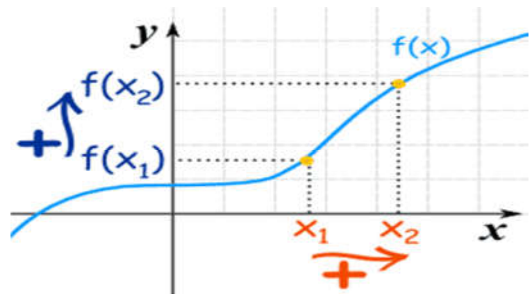


Figure 2

If f'(c) is negative it means that f(x) is an de creasing function as x increases via c

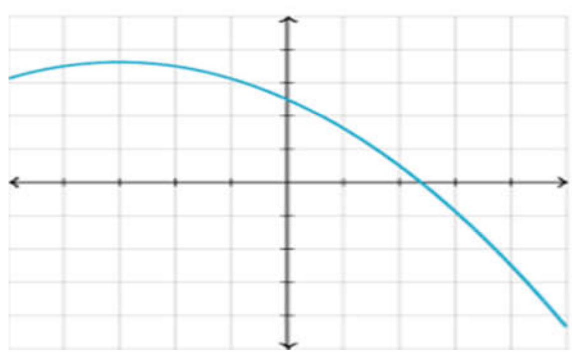


Figure 3

NOTE: f'(c) is the slope of the tangent to the curve y=f(x) at x=c .

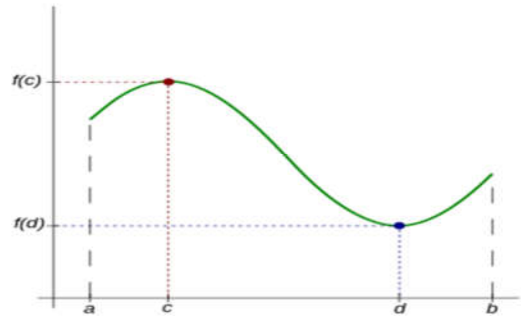
2. Properties of Continuoue Function

If f(x) is continuous in closed interval [α, β] , f(x) is bounded there in it attains its greatest

Lower bound and the least upper bound of f(x) in [α, β] . there exist points c and d in [α, β] .

Such that f(c) =m, f(d)=M

If f(x) is continuous in closed interval [α,β] and f(α) and f(β) are of opposite signs than
there exist atleast one point c in open interval (α,β) such that f(c)=0

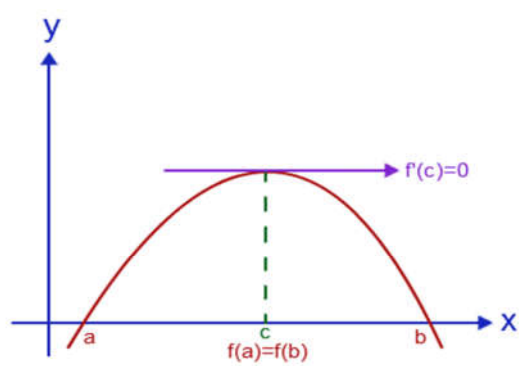


3. Rolle's theorem

Let f(x) be a function such that .It is continuous in closed interval [α,β] .It is differntiable in open interval (α,β) andf(α)=f(β) then there exist one point c in open interval (α,β) Such that $f^{'}$(c)=0

3.1 Geometrical interpretation of Rolle's Theorem

. The curve y= f(x) is continuous in the [α,β] At every point x=c where α<c<β at the point (c,f(c)) on the curve y=f(x), there Is a unique tangent to the curve. f(α)=f(β)



There is atleast one point on the curve where the only one tangent to the curve Is parallel to the X-axis according to the Rolle's theorem

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