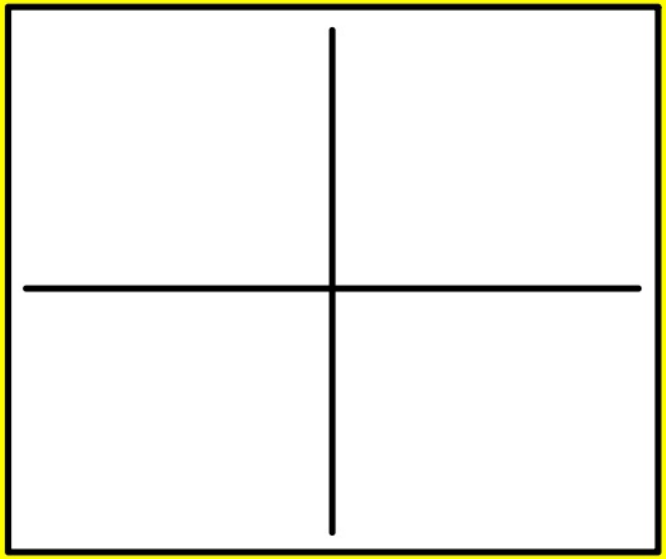
Theorems About Maximums and Minimums

The Extreme Value Theorem

A continuous function on a closed interval [a,b] must have an absolute maximum and minimum.

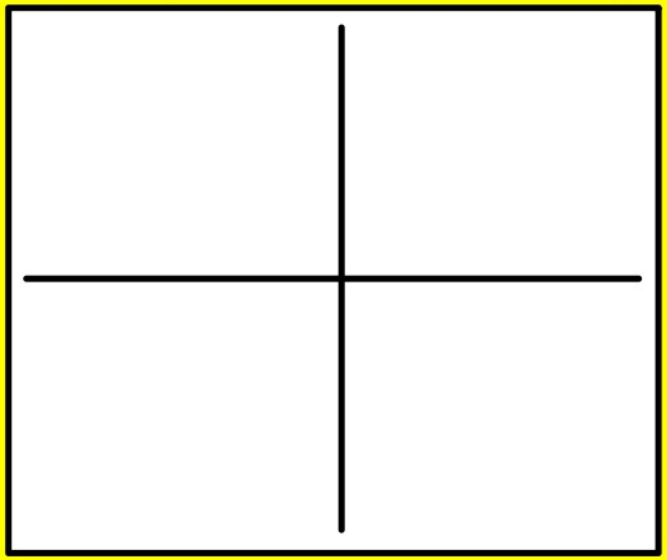


EVT | Rolles

Theorems About Maximums and Minimums

Rolle's Theorem

Let *f* be continuous on [a,b] and differentiable on (a,b). If f(a) = f(b), then there is at least one value *c* in (a,b) such that f'(c) = 0



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Apply Rolle's Theorem if Applicable

$$f(x) = x^2 - 5x + 4, [1,4]$$

1 2 3 4

Apply Rolle's Theorem if Applicable

$$f(x) = \cos 2x, [0, p]$$

1 2 3 4

Apply Rolle's Theorem if Applicable

Find the x-intercepts of $f(x) = (x^2 - 2x - 3)/(x+2)$ and apply Rolle's Theorem if possible.

1 2 3 4

Apply Rolle's Theorem if Applicable

$$h(x) = 3 - |x - 3| \text{ , } [0, 6]$$

1 2 3 4

Mean Value Theorem

If *f* is continuous on the closed interval [a,b] and differentiable on the open interval (a,b), then there exists a number *c* in (a,b) such that:

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

Demo

Apply MVT if Applicable

$$f(x) = x^3 - x^2 - 2x, [-1,1]$$

1 2 3 4

Apply MVT if Applicable

$$f(x) = (x+1)/x, [1/2, 2]$$

1 2 3 4

Apply MVT if Applicable

Given $g(x) = x^3$ on the interval [0,2], find the equation of the tangent line at the point c described in the MVT.

1 2 3 4

Apply MVT if Applicable

The height of an object t seconds after it is dropped from a height of 300 meters is $s(t) = -4.9t^2 + 300$.

a) Find the average velocity of the object after 2 seconds.

b) At what point of the fall was the object falling at the average?

Understanding Concepts

Let *f* be continuous on [a,b] and differentiable on (a,b). If there exists *c* in (a,b) such that f'(c) = 0, does it follow that f(a) = f(b)? Explain.

1 2 3 4

Understanding Concepts

Let *f* be continuous on [a,b] and differentiable on (a,b). Also, suppose that f(a) = f(b) and that *c* is a real number in (a,b) such that f'(c)=0. Find an interval for the function *g* over which Rolle's can be applied and find the corresponding critical number of *g* (k is a constant)

a) g(x) = f(x)+k

b) g(x) = f(x-k)

c) g(x) = f(kx)

1 2 3 4

Understanding Concepts

The function:

$$f(x) = \begin{cases} 0, & x = 0 \\ 1 - x, & 0 < x \leq 1 \end{cases}$$

is differentiable on (0,1) and satisfies f(0) = f(1). However, its derivative is never zero on (0,1). Does this contradict Rolle's Theorem? Explain.

Understanding Concepts

Can you find a continuous and differentiable function *f* such that f(-2)=-2, f(2) = 6 and f'(x) < 1 for all x? Explain.

1 2 3 4