When you are done with your homework you should be able to…

π Understand and use Rolle's Theorem

π Understand and use the Mean Value Theorem

Warm-up: Locate the global extrema of the function $f(x) = x^3 - 12x$ on the closed interval $[0,4]$.
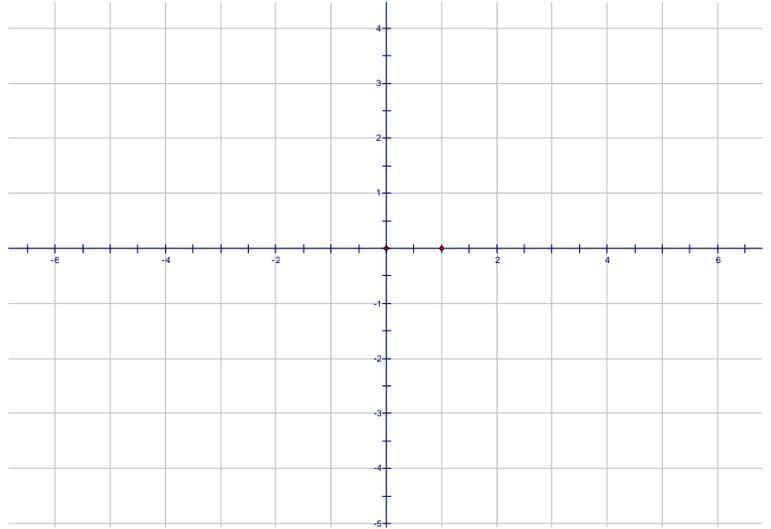
ROLLE'S THEOREM

The _____ Value Theorem states that a continuous function on

a closed interval _____ must have both a _____

and a _____. Both of these values, however, can occur

at the _____. Rolle's Theorem gives conditions that

guarantee the existence of an extreme value in the _____ of a

closed interval.

THEOREM: ROLLE'S THEOREM

Let f be continuous on the closed interval $[a,b]$ and differentiable on the open interval (a,b). If $f(a) = f(b)$ then there is at least one number c in (a,b) such that $f'(c) = 0$.

Example 1: Determine whether Rolle's Theorem can be applied to f on the closed interval $[a,b]$. If Rolle's Theorem can be applied, find all values of c in the open interval (a,b) such that $f'(c)=0$.

a. $f(x)=\cos 2x, \ [-\pi, \pi]$

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

THEOREM: THE 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

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

Example 2: Consider the function $f(x) = \sqrt{x}$ on the closed interval from $[1,9]$.

a. Graph the function on the given interval.

b. Find and graph the secant line through the endpoints on the same coordinate plane.

c. Find and graph any tangent lines to the graph of f that are parallel to the secant line.