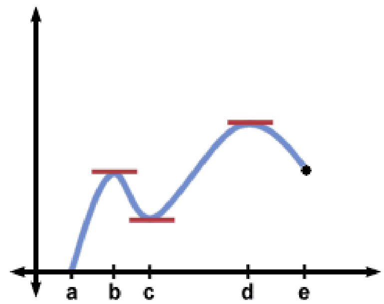
Critical Point Theorem (Fermat's Theorem- Stationary Points)

Note that f has local extrema at $x = b$, $x = c$, and $x = d$.

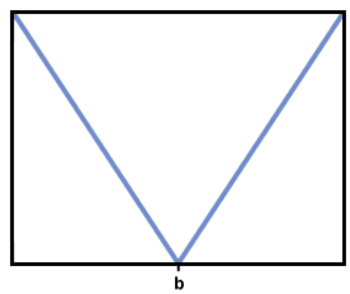


The tangent to the graph at each of these points is horizontal.

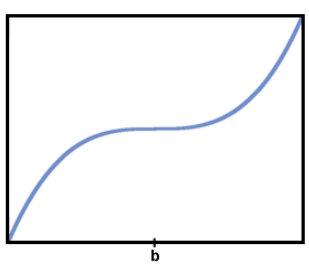
It is in fact always the case that: if f has a local extrema at b and $f'(b)$ exists, then $f'(b) = 0$.

Sometimes, it is also possible for a continuous function to have a local extremum at a point where the derivative does not exist.

For example, the function $f(x) = |x - b|$ has a local min at $x = b$.



Note that the converse of this theorem is not true. It is not the case that all critical points are local extrema. For example, in the graph below, the point $x = b$ has a horizontal tangent, so $f'(b) = 0$, but f does not have a local extremum at b:



A critical number, c, is a number in the domain of f such that $f'(c) = 0$ or $f'(c)$ is undefined.