Graphing: What do $f'(x)$ and $f''(x)$ tell you about the graph of $f(x)$?

First derivative test : Suppose that c is a critical number of a continuous function f.

(a) If f' changes from positive to negative at c, then f has a local maximum at c.

(b) If f' changes from negative to positive at c, then f has a local minimum at c.

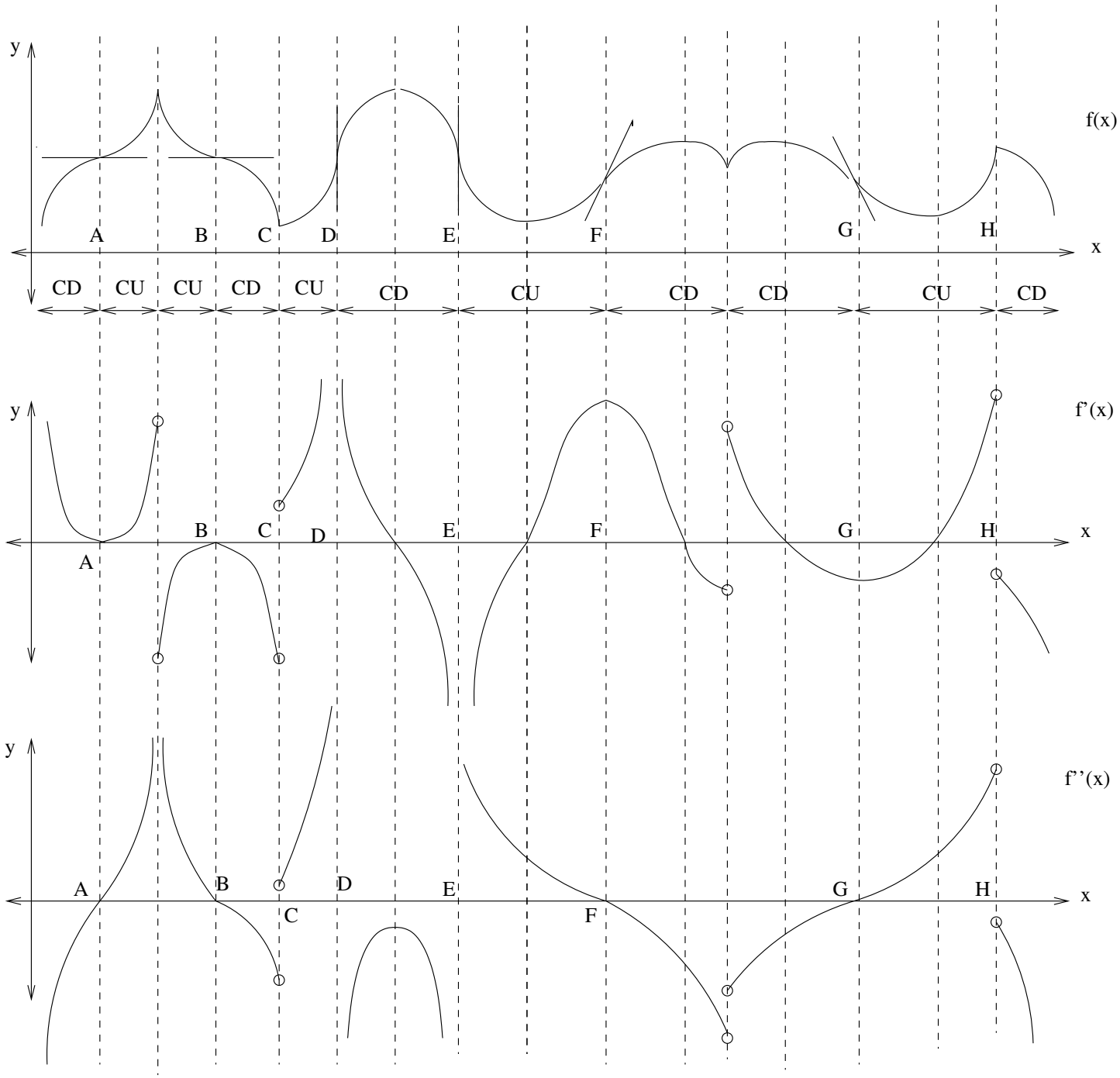
(c) If f' does not change sign at c (that is, f' is positive on both sides of c or negative on both sides) then f has no local maximum or minimum at c.

Definition If the graph of f lies above all of its tangents on an interval $[a, b]$ then it is called concave upward, (CU) on $[a, b]$. If the graph of f lies below all of its tangents on $[a, b]$, it is called concave downward, (CD) on $[a, b]$.

Concavity test

(a) If $f''(x) > 0$ for all $x \in [a, b]$ then the graph of f is concave up on $[a, b]$.

(b) If $f''(x) < 0$ for all $x \in [a, b]$ then the graph of f is concave down on $[a, b]$.



(Handout for Math 1550, section 5 (Dr. H. Verrill). Picture of $f(x)$, $f'(x)$, and $f''(x)$ by Dr. J. Cazaran. For October 22 2004.)