

HERE ARE SOME GENERAL TIDBITS ABOUT THE RELATIONSHIP AMONG f , f' , AND f'' . ALL THESE ASSUME f IS SUFFICIENTLY “NICE” (LIKE f'' EXISTS “ALMOST EVERYWHERE”).

- The general relationship is
 - f' gives increasing/decreasing information about f .
 - f'' gives concavity information about f .
- On an open interval, the relationship is

f''	f'	f
positive	increasing	concave up
negative	decreasing	concave down
zero	constant	linear

- f has a local maximum where f' changes from positive to negative. f has a local minimum where f' changes from negative to positive.
 - f has a point of inflection where f'' changes from positive to negative, or vice-versa. So, f has a point of inflection where f' has a local maximum or a local minimum.
- Local extrema for f *must* occur at critical points for f (points where $f'(c) = 0$ or $f'(c)$ DNE), but not all critical points for f correspond to local extrema for f .
 - Points of inflection for f *must* occur at critical points for f' (points where $f''(c) = 0$ or $f''(c)$ DNE), but not all critical points for f' correspond to points of inflection for f .
- **Remark.** *Never* use the pronoun “it” when explaining something about the relationship among f , f' , or f'' . Sentences like “It’s positive so it’s increasing so it’s concave up” are too vague to be of any use.