MATH 235 **A note on f, f', and f''**

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

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  - 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 minumum.
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  - 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.