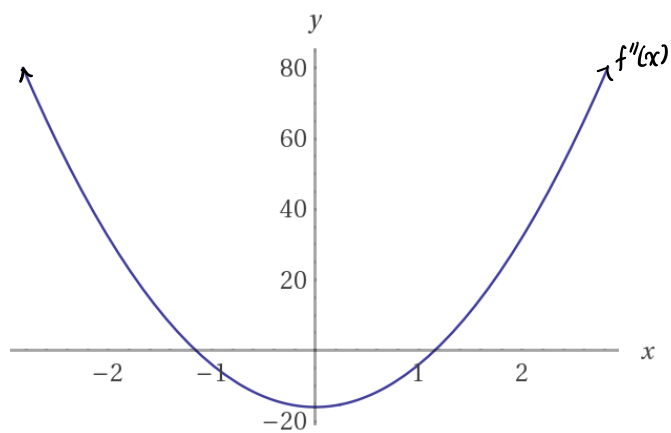
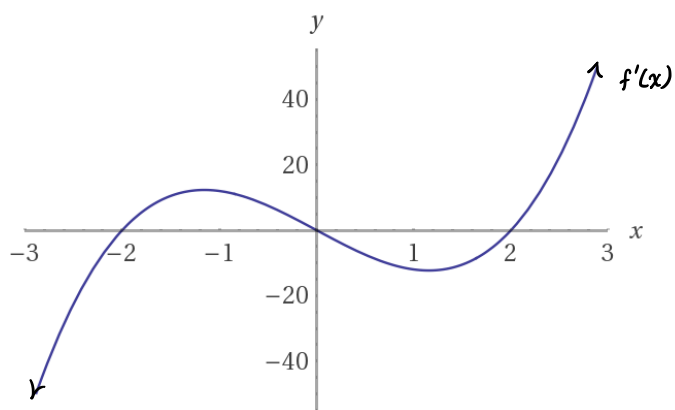
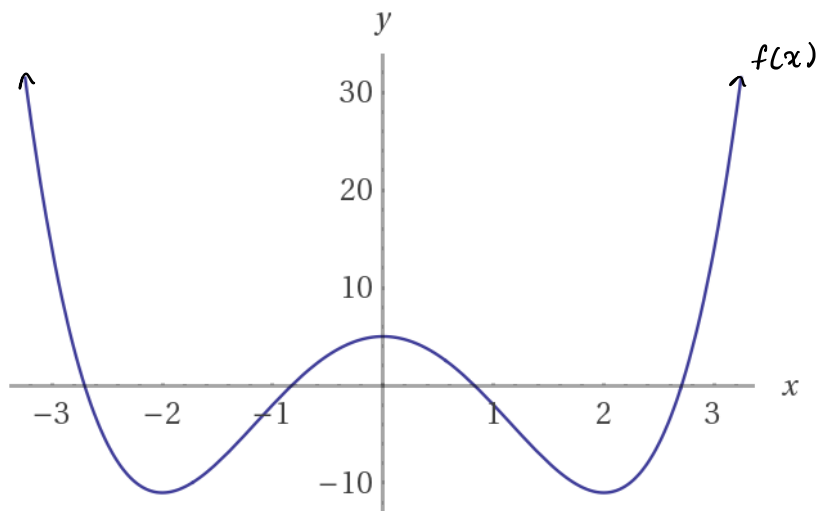


1. (a) Let $f(x) = x^4 - 8x^2 + 5$. Using the graphs of $f(x)$, $f'(x)$, and $f''(x)$, estimate the following:

- Critical points of $f(x)$
- Intervals where $f(x)$ is increasing or decreasing
- Points of inflection of $f(x)$
- Intervals where $f(x)$ is concave up or concave down



(b) Using the *first derivative test*, we'll check our answers from above. Determine the following using calculus:

- Critical points of $f(x)$
- Intervals where $f(x)$ is increasing or decreasing

(c) Using calculus, determine the following:

- Points of inflection of $f(x)$
- Intervals where $f(x)$ is concave up or concave down

2. *Pineapple* is an up-and-coming tech startup. Their current cost and revenue functions (in dollars) are given below.

$$R(q) = 5q - 0.003q^2$$

$$C(q) = 300 + 1.1q$$

where q is quantity and $0 \leq q \leq 1000$.

- (a) What production levels give the maximum profit? What about the minimum profit?



3. The company *Beets by Go* is studying the rate at which photosynthesis takes place in the leaf of a beet plant.

For time $t \geq 0$ in days, the rate at which photosynthesis takes place, represented by the rate at which oxygen is produced, is approximated by:

$$p(t) = 100 (e^{-0.02t} - e^{-0.1t})$$

- (a) When is photosynthesis occurring fastest in the beet plants? What is that rate?

