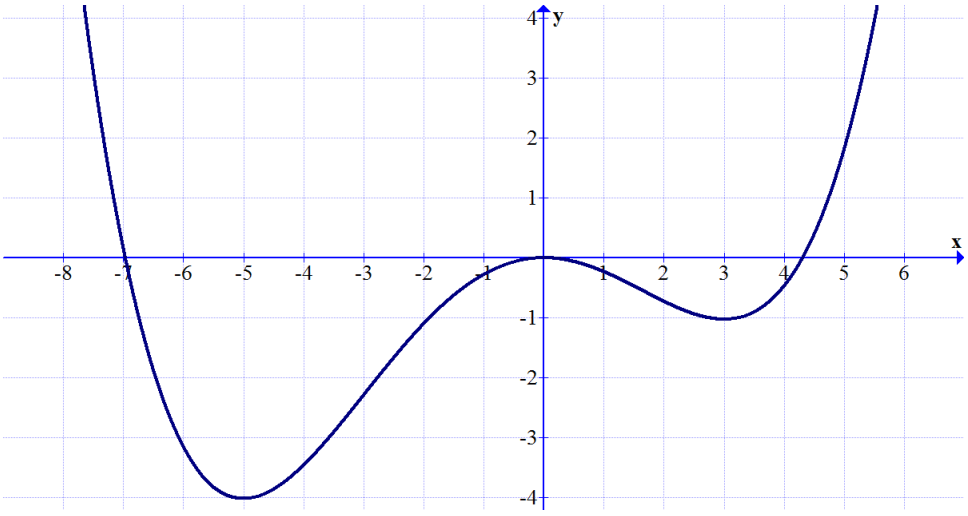
Chapter 4.4 Practice Problems

EXPECTED SKILLS:

- Be able to find the absolute maxima and minima of a function, and where they occur, over a given interval.
- Be able to state and apply the Extreme Value Theorem, where appropriate.

PRACTICE PROBLEMS:

1. Consider the graph of $y = f(x)$, shown below. For each of the following, compute the absolute maximum and absolute minimum values of $f(x)$ on the given interval, if they exist. (Make reasonable assumptions about the behavior of the function outside of the shown interval.)



   (a) $(-\infty, \infty)$
   (b) $[-7, 5]$
   (c) $[-6, -2]$
   (d) $[-7.5, -6]$
   (e) $(-4, 1)$

2. Sketch the graph of a continuous function, $y = f(x)$, which has all of the following properties:

   - $f(x)$ has a domain of $[1, 7]$
   - $f(x)$ has an absolute maximum of 6 when $x = 2$ and an absolute minumum of -1 when $x = 5$.
   - $f''(x) > 0$ for all x in the domain of $f(x)$, with the exception of $x = 2$ where $f''(x)$ DNE.

For each of the following, find the absolute maximum and minimum values of $f(x)$ on the given interval.

3. $f(x) = x^2 + 3x - 4$ on $[-3, 3]$.
4. $f(x) = (2x + 1)^3$ on $[-1, 4]$.
5. $f(x) = \dfrac{x - 3}{(x - 4)^2}$ on $[-4, 1]$.
6. $f(x) = \cos x - \sin x$ on $[-\pi, \pi]$.
7. $f(x) = \sqrt{1 - x^2}$ on $[-1, 1]$
8. $f(x) = |x - 3|$ on $[-5, 5]$
9. $f(x) = x^{\frac{1}{3}}(x - 5)^2$ on $[1, 10]$
10. $f(x) = \tan x + \sin x$ on $\left[-\dfrac{\pi}{4}, \dfrac{\pi}{4}\right]$
11. $f(x) = 3x^2 - 4x + 9$ on $(-\infty, \infty)$
12. $f(x) = -x^2 + 5x - 10$ on $(-\infty, \infty)$
13. $f(x) = \dfrac{x - 2}{x + 5}$ on $(-\infty, \infty)$
14. $f(x) = x^2 e^{-2x}$ on $(-\infty, \infty)$