Math 221 06
Prof. Doug Baldwin

Problem Set 9 — The Shapes of Graphs

Complete by **Monday, November 4**
Grade by **Thursday, November 7**

Purpose

This problem set reinforces your understanding of ways in which ideas from calculus capture information about the shapes of function's graphs. By the time you finish this problem set you should be able to ...

- Use information about derivatives to infer information about where a graph is increasing or decreasing and about its concavity
- Deduce information about derivatives from the appearance of graphs
- Find limits at positive or negative infinity.

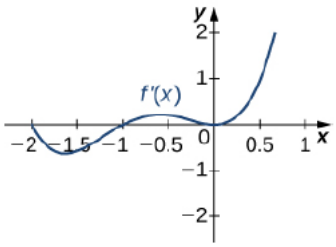
Background

This problem set is based on material from sections 4.5 and 4.6 of our textbook. We discussed this material in class between October 24 and 28.

Activity

Solve the following problems:

Question 1. (Exercise 206 in section 4.5 of OpenStax *Calculus, Volume 1 for SUNY Geneseo*) Given this graph of $f'(x)$, list the sub-intervals of $[-2, 0.5]$ where $f(x)$ is increasing, the sub-intervals where it is decreasing, and the points at which minima or maxima are located.



Question 2. (Exercise 216 in section 4.5 of OpenStax *Calculus, Volume 1 for SUNY Geneseo*) Sketch a graph of a function $f(x)$ that has the following features over the interval $[-3, 3]$:

- $f(x) > 0$ everywhere in the interval
- $f'(x) > 0$ for $x < 0$
- $f'(x) = 0$ for $0 < x < 1$
- $f'(x) > 0$ for $x > 1$

Question 3. (Exercise 218 in section 4.5 of OpenStax *Calculus, Volume 1 for SUNY Geneseo*) Sketch a graph of a function $f(x)$ that has the following features over the interval $[-3, 3]$:

- f has a local maximum at $x = 0$
- f has local minima at $x = -2$ and $x = 2$
- $f''(x) > 0$ for $x < -1$
- $f''(x) < 0$ for $-1 < x < 1$
- $f''(x) > 0$ for $x > 1$

Question 4. Evaluate

$$\lim_{x \to \infty} \frac{e^{2x} + e^x}{e^{3x}}$$

Question 5. (Exercise 264 in section 4.6 of OpenStax *Calculus, Volume 1 for SUNY Geneseo*)

Find

$$\lim_{x \to -\infty} \frac{3x^3 - 2x}{x^2 + 2x + 8}$$

Follow-Up

I will grade this exercise in a face-to-face meeting with you. During this meeting I will look at your solution, ask you any questions I have about it, answer questions you have, etc. Please bring a written solution to the exercise to your meeting, as that will speed the process along.

Sign up for a meeting via Google calendar. Please make the meeting 15 minutes long, and schedule it to finish before the end of the "Grade By" date above.