This is an optional assignment that will be worth 2 points of extra credit. You must show work to get credit.

**NOTE:** These are just review problems of Lectures 20-28; these are not necessarily representative of the problems of the exam. The exam can (and most likely will) have different problems.

**Directions**:

1. Complete each problem on the next page, make sure to show your work. Clearly mark the question number and final answer.
2. You have two options to turn in this assignment:
   (a) **In-person:** You can slip it under my office door located in MATH 615. Make sure your name is on it and that it is stapled together (if there are multiple pages).
   (b) **Email:** You may email your assignment to me at pence11@purdue.edu
      i. Scan your assignment so that it is one PDF (do not submit a bunch of images).
      ii. In the subject line, write "EXTRA CREDIT 3 [your name]".
3. The answers will be given in the lecture after the due date (11/7). Therefore, **no late submissions will be allowed**.

**Topics of Exam 3:**

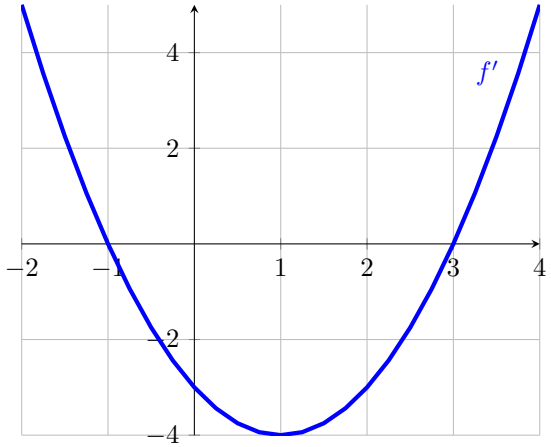
- **Lecture 20:** Graphical Interpretation of Derivatives
- **Lecture 21:** Limits at Infinity
- **Lecture 22:** A Summary of Curve Sketching
- **Lecture 23-25:** Optimization
- **Lecture 26-27:** Antiderivatives and Indefinite Integration
- **Lecture 28:** Area and Riemann Sums

**Problem 1.** *A graph of $f'$ is given below.*

*(a) Determine when $f$ is increasing and when it is decreasing.*

*(b) Determine when $f$ is concave up and when it is concave down.*

*(c) Locate the positions ($x$-coordinates) of any relative extrema and inflection points.*



**Problem 2.** *Compute* $\lim_{x\to\infty} \frac{x^2+1}{2-x}$ *and* $\lim_{x\to-\infty} \frac{x^2+1}{2-x}$.

**Problem 3.** *Use the techniques learned in Lecture 22 to sketch a graph of the function* $y = \frac{x^2}{x+8}$.

**Problem 4.** *If a rectangle has a fixed perimeter of* 40*, what is its maximum area?*

**Problem 5.** *Find the point on the line* $6x + y = 9$ *that is closest to the point* $(-3, 1)$.

**Problem 6.** *A particle is moving through space; its acceleration function is given by* $a(t) = \cos t + \sin t$ *for* $t \geq 0$. *Find the position of the particle at time* $t$ *when* $s(0) = 0$ *and* $v(0) = 5$.

**Problem 7.** *We estimate the area underneath the graph of* $f(x) = \frac{1}{x}$ *on the interval* $[1, 5]$.

*(a) Compute the left Riemann sum with* 4 *rectangles. Is this an overestimate or an underestimate? Explain why (The exact area is* $\ln 5$*, but you don't need to know that to answer the question).*

*(b) Repeat (a) using the right Riemann sum.*

*(c) Set up (but do not compute) the left Riemann sum using* $N$ *rectangles (where* $N$ *is a positive integer).*