Due before tutorial, monday October 22nd.

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- Please **STAPLE** your work together before submitting!
  It's painful for Aonghus to mark assignments on loose sheets.
  And it's quite unfair to ask him to staple your pages for you!
- Problems titled [**SELF**] are for your own practice and will not be marked.
- If any calculations are required to obtain your answers, please show them. Your work will be marked for your reasoning/calculations as well as for giving the correct final answer.

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1. Consider the linear function

$$f(x) \;=\; -\frac{1}{2}x + 1$$

   (a) [**4 pts.**] This function represents a straight line. What are the slope and y-intercept of the line?

   (b) [**6 pts.**] Using the slope and y-intercept, sketch a plot of the function. Do NOT use a calculator. Explain in words how you used the slope and y-intercept to plot the function.

2. (a) [**6 pts.**] Consider the function

$$f_1(x) = |(x-2)| \ .$$

   From a plot of the function, find out what the slope is for $x > 2$ and $x < 2$. Use this information to sketch a plot of the derivative $f_1'(x)$.

   (b) [**6 pts.**] Consider the function

$$f_2(x) = \frac{|x|}{x} \ .$$

   Considering the slope of the function, sketch a plot of the derivative $f_2'(x)$.

(c) **[6 pts.]** Consider the function

$$f_3(x) = \frac{2x + |x|}{x}\,.$$

By finding the slope of the function in different regions, sketch a plot of the derivative $f_3'(x)$.

(d) **[4 pts.]** Consider the function

$$f_4(x) = 2x - 4\,.$$

By finding the slope of the function in different regions, sketch a plot of the derivative $f_4'(x)$.

3. Evaluate the following limits. If the limit does not exist, explain why.

In each case, also provide a sketch of the graph of the function in the relevant region, e.g., if you are evaluating $\lim_{x\to a} g(x)$, then plot the function $g(x)$ in the region around $x = a$.

(a) **[3 pts.]** $\lim_{x\to 1}(5x^2 - 3)$

(b) **[3 pts.]** $\lim_{x\to 1}\left(\frac{(x-1)^2}{x-1}\right)$

(c) **[3 pts.]** $\lim_{x\to 1}\left(\frac{|x|}{x}\right)$

(d) **[3 pts.]** $\lim_{x\to 0}\left(\frac{1}{x}\right)$

(e) **[3 pts.]** $\lim_{x\to 0}\left(\frac{x}{|x|}\right)$

(f) **[3 pts.]** $\lim_{x\to 1}\left(\frac{x}{x-1}\right)$

(g) **[SELF]** $\lim_{x\to 0}\left(\frac{x^2}{|x|}\right)$

(h) **[SELF]** $\lim_{x\to 0}\left(\frac{(a+x)^2 - a^2}{x}\right)$

(i) **[SELF]** $\lim_{x\to 0}\left(x + \frac{1}{x}\right)$

(j) **[SELF]** $\lim_{x\to 0}\left(\frac{x + x^2}{x}\right)$

(k) **[SELF]** $\lim_{x\to 1}\left(\frac{|x-1|}{x-1}\right)$

(l) **[SELF]** $\lim_{x\to 0}\left(x + \frac{|x-1|}{x-1}\right)$