ESP Math 179 **Spring 2016**

Worksheet 3

19 January 2016

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1. **Warm up:** Let $f(x) = 2x + 1$ and $h(x) = f(x - 2)$ be two functions. Evaluate the following expressions:

   (a) $h(0)$

   (b) $h(1)/2$

   (c) $f\left(\sqrt{\ln(e^4)}\right)$

   (d) $f(h(f(2) + 3) + 3) + 3$

   (e) $\dfrac{h(27)}{f(-3)} - \dfrac{h(3^3)}{h(-1)}$

2. Evaluate the following limits, if they exist.

   (a) $\lim\limits_{x \to 0} [\ln(x + 1)]$

   (b) $\lim\limits_{x \to 1} \left[\dfrac{x^2 - 1}{x - 1}\right]$

   (c) $\lim\limits_{y \to 4} \left[\dfrac{y^2 - y - 12}{\sqrt{y} - 2}\right]$

   (d) $\lim\limits_{z \to 3} \left[\dfrac{3 - z}{z - 3}\right]$

   (e) $\lim\limits_{w \to 3} \left[\dfrac{|w - 3| + |w - 3|}{2w - 6}\right]$

   (f) $\lim\limits_{h \to 0} \left[\dfrac{(4(x + h) - 1) - (4x - 1)}{h}\right]$

3. Consider the following function:

$$f(x) = \begin{cases} x^2 & \text{if } x \leqslant -1, \\ ax + b & \text{if } -1 < x < 1, \\ |x| & \text{if } x \geqslant 1. \end{cases}$$

(a) Find a pair of real numbers a, b that make the function f have no jumps.

(b) With the pair you found in part (a), graph f on a grid.

4. Let $f(x) = \sin(1/x)$.

(a) What is the domain of f?

(b) What is the range of f?

(c) What is $\lim_{x \to \infty} [f(x)]$, if it exists?

(d) What is $\lim_{x \to 0} [f(x)]$, if it exists?

(e) Graph $f(x)$.