**1.** Sketch the graph y = f(x) of a function which has all of the following properties; do not worry about any *formula* for f(x):

(a) 
$$f(0) = 3$$

(b) 
$$\lim_{x\to 0} f(x) = 0$$

(c) 
$$\lim_{x\to -2^-} f(x) = 1$$

(d) 
$$\lim_{x\to -2^+} f(x) = -1$$

(e) 
$$\lim_{x\to 5^-} f(x)$$
 d.n.e.

(f) 
$$\lim_{x\to 5^+} f(x) = -\infty$$

(g) the domain of 
$$f$$
 is  $(-\infty, \infty)$ 

**2.** Evaluate the limit, if it exists:

$$\lim_{h \to 0} \frac{(2+h)^3 - 8}{h} =$$

**3.** Evaluate the limit, if it exists:

$$\lim_{u \to 2} \frac{\sqrt{4u+1} - 3}{u - 2} =$$

**4.** Evaluate the limit, if it exists:

$$\lim_{t\to 0}\left(\frac{1}{t\sqrt{1+t}}-\frac{1}{t}\right)=$$

**5.** Evaluate the limit, if it exists:

$$\lim_{x\to 3}\frac{\frac{1}{x}-\frac{1}{3}}{x-3}=$$

- 6. Evaluate the limits, if they exist, and otherwise explain why they do not:
- (a)

$$\lim_{x \to 0^-} \left( \frac{1}{x} - \frac{1}{|x|} \right) =$$

(b)

$$\lim_{x \to 0^+} \left( \frac{1}{x} - \frac{1}{|x|} \right) =$$

7. Challenge problem. Consider the following function:

$$f(x) = \begin{cases} 1, & \text{if } x \text{ is rational} \\ 0, & \text{if } x \text{ is irrational} \end{cases}$$

Evaluate the limit  $\lim_{x\to 0} f(x)$  if it exists. If it does not exist, explain why.