- **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.