**Quiz #1 (Tuesday)**

- laws for exponentials/logarithms
- sketch trig function, determine value of inverse

**Review.** compound interest, APR vs APY, $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e$

**Example 12. (real life)** My car loan contract quotes an APR of $6.79\%$ (and compounds monthly). What is the APY?

**Solution.** Since $\left(1+\frac{0.0679}{12}\right)^{12} \approx 1.07005$, the APY is about $7.01\%$.

[Obviously, the lender prefers to quote the lower but less meaningful APR.]

# Limits and Continuity

$$\lim_{x\to c} f(x) = L$$

means that $f(x)$ approaches the value $L$ as $x$ approaches the value $c$.

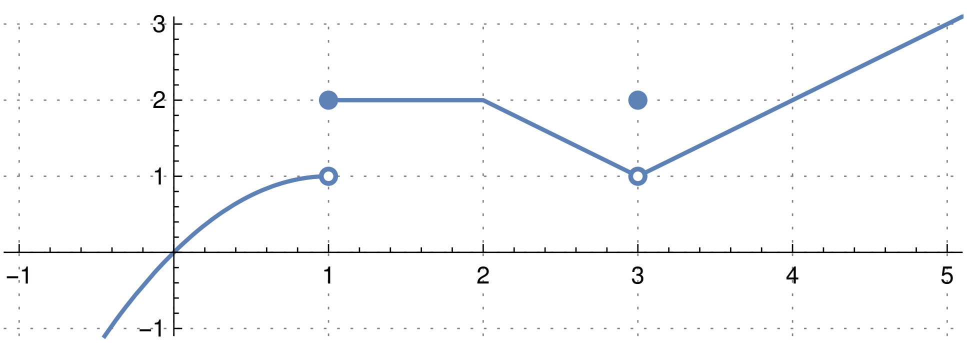
More precisely, $f(x)$ is as close to $L$ as we want for all $x$ (different from $c$ but) sufficiently close to $c$.

We will soon make it very precise what we mean by "approach"! For now, let us build some first intuition.

Similarly, we have the one-sided limits

- $\lim_{x\to c^-} f(x) = L$ for the case when $x$ approaches $c$ from the left, and
- $\lim_{x\to c^+} f(x) = L$ for the case when $x$ approaches $c$ from the right.

**Example 13.** For $f(x)$ as sketched below, discuss the limits $\lim_{x\to c} f(x)$ for $c = 1, 2, 3, 4$ as well as the corresponding one-sided limits.

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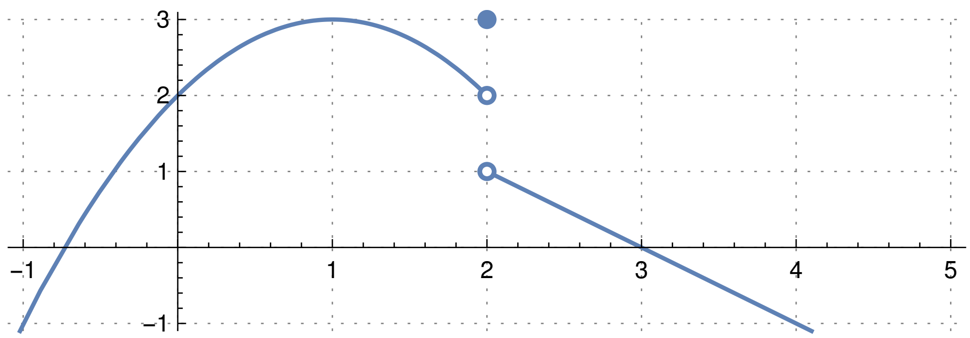
**Solution.**

- ($c=1$) $\lim_{x\to 1^-} f(x)=1$ while $\lim_{x\to 1^+} f(x)=2$, so that $\lim_{x\to 1} f(x)$ does not exist.
  [Note that $f(1)=2$, but that this is irrelevant for the limits.]
- ($c=2$) $\lim_{x\to 2} f(x)=2$ (which automatically implies that $\lim_{x\to 2^-} f(x)=2$ and $\lim_{x\to 2^+} f(x)=2$ as well)
- ($c=3$) $\lim_{x\to 3} f(x)=1$ (which automatically implies that $\lim_{x\to 3^-} f(x)=1$ and $\lim_{x\to 3^+} f(x)=1$ as well)
  [Note that $f(3)=2$, but that this is irrelevant for the limits.]
- ($c=4$) $\lim_{x\to 4} f(x)=2$ (which automatically implies that $\lim_{x\to 4^-} f(x)=2$ and $\lim_{x\to 4^+} f(x)=2$ as well)

**Example 14.** Sketch a function with $\lim_{x\to 2^-} f(x)=2$, $\lim_{x\to 2^+} f(x)=1$ and $f(2)=3$.

**Solution.** The possibilities are endless. Here's one such $f(x)$:

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