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1. Use the properties of limits to decide if the following limit exists. If does exist, find its value.

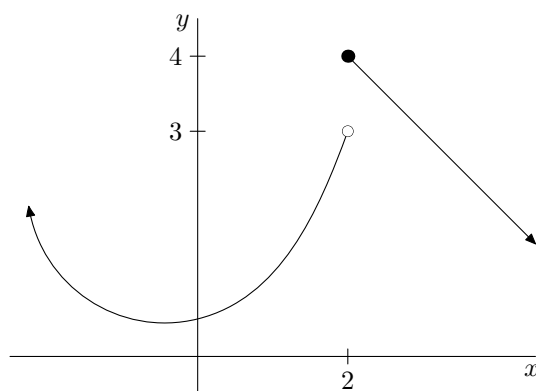
$$\lim_{x \rightarrow -2} \frac{x^2 - 2x - 8}{x + 2}$$

Solution. We compute as follows:

$$\begin{aligned} \lim_{x \rightarrow -2} \frac{x^2 - 2x - 8}{x + 2} &= \lim_{x \rightarrow -2} \frac{(x - 4)(x + 2)}{x + 2} && \text{factoring} \\ &= \lim_{x \rightarrow -2} x - 4 && \text{canceling, as } x + 2 \neq 0 \\ &= -6 && \text{since } p(x) = x - 4 \text{ is a polynomial} \end{aligned}$$

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2. Using the graph below, find $\lim_{x \rightarrow 2^-} f(x)$, $\lim_{x \rightarrow 2^+} f(x)$, $\lim_{x \rightarrow 2} f(x)$, and $f(2)$, if they exist.



Solution. We have

$$\lim_{x \rightarrow 2^-} f(x) = 3, \quad \lim_{x \rightarrow 2^+} f(x) = 4, \quad \lim_{x \rightarrow 2} f(x) \text{ does not exist,} \quad f(2) = 4.$$