# MATH 100, Tutorial 2
# (Week of January 22, 2024)

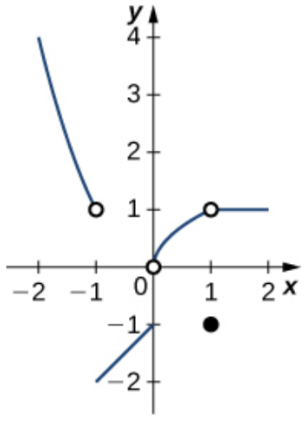
## Pre-lab Preparation

Before most lab sessions you will need to do some preparation work. Your lab instructor may call upon you to present your answer to the class. It is important to try each of these even if you can not complete them correctly. You must bring your written answers to your lab session and it will be marked at the beginning.

**For this week you need to:**

- (a) Do exercise 1-part (f), exercise 2-parts (a), (c) and (d)
- (b) Review the material on **Determining Continuity at a Point** from Section 2.4 and the **Squeeze Theorem** (Theorem 2.7) from your text.

**Exercise 1.** Using the graph, find each limit or explain why the limit does not exist.




**(a)** $\lim_{x\to 1} f(x)$. **(b)** $\lim_{x\to -1} f(x)$. **(c)** $\lim_{x\to -1^-} f(x)$.

**(d)** $\lim_{x\to -1^+} f(x)$. **(e)** $\lim_{x\to 0^+} f(x)$. **(f)** $\lim_{x\to 2} f(x)$.

**Exercise 2.** In the following exercises, evaluate the limit algebraically or explain why the limit does not exist. Also, answer the additional question next to the given limit in some instances.

**(a)** $\lim_{x\to 3^-} \dfrac{3x^2 - 12x + 9}{x - 3}$

**(b)** $\lim_{x\to+\infty} \dfrac{x^2 - 2x}{x^4 + 4}$; $\lim_{x\to+\infty} \dfrac{3x^4 - 2x}{x^4 + 4}$; $\lim_{x\to-\infty} \dfrac{x^4 - 2x}{x^2 + 4}$

**(c)** $\lim_{x\to 2} \dfrac{x^2 - 4}{x - 2}$

**(d)** $\lim_{x\to 5} \dfrac{x^2 - 25}{\sqrt{x} - \sqrt{5}}$.

**Additional question.** Is the function $f$ defined by $f(x) = \dfrac{x^2 - 25}{\sqrt{x} - \sqrt{5}}$ (for $x \neq 5$) and $f(5) = 10$ continuous at $x = 5$?

**Exercise 3.** Determine the value of c such that the function $f$, defined below, remains continuous.

$$f(x) = \begin{cases} x^2 + 4 & \text{for } x \leq c \\ 4x & \text{for } x > c. \end{cases}$$

**Exercise 4.** Compute, giving the necessary justification,

1. $\lim_{x\to 0^+} x^3 \sin\left(\dfrac{1}{x}\right)$.
2. $\lim_{x\to 0} x^2 \cos\left(\dfrac{2\pi}{x}\right)$.
3. $\lim_{x\to \frac{\pi}{2}} (x - \pi/2)^2 \cos\left(\dfrac{2\pi}{(x - \pi/2)}\right)$.
4. $\lim_{x\to 0} \dfrac{x^3 - x - \sin x}{x}$.