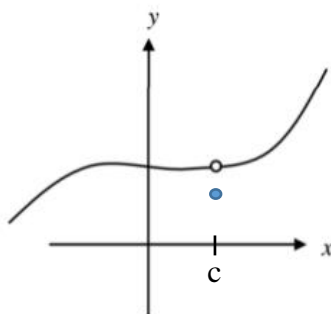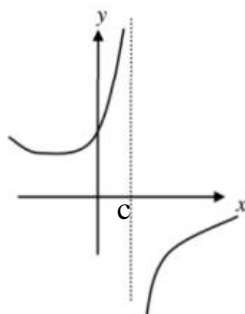*The idea of continuity:* A function is continuous if you can draw the entire function without lifting your pencil from the paper.
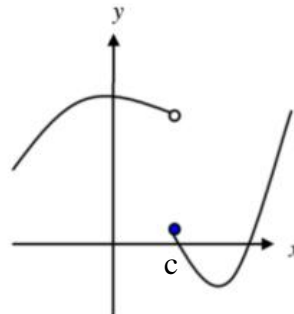
Types of Discontinuities

Removable Discontinuity
Hole in the graph

Non-Removable Discontinuity
Vertical Asymptote

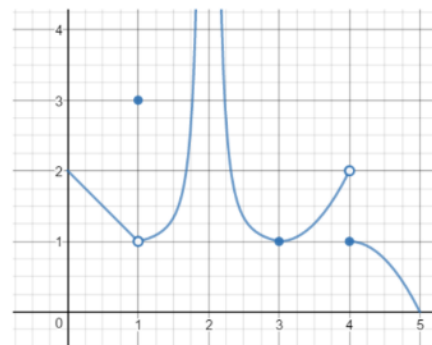Non-Removable Discontinuity
Jump

Definition of Continuity

A function is continuous at a point $x = c$ if $\lim\limits_{x \to c} f(x) = f(c)$.

To prove a function is continuous at $x = c$, show:

① $f(c)$ exists

② $\lim\limits_{x \to c} f(x)$ exists

③ $f(c) = \lim\limits_{x \to c} f(x)$

Example 1: Given the graph of the function f to the right,

a) identify where f is discontinuous and explain why.

b) identify the interval(s) on which f is continuous.

Example 2: For what values of x is $f(x)$ continuous?

$$f(x) = \begin{cases} x^2 - 3x, & x \leq 2 \\ 3, & 2 < x < 4 \\ -1, & x = 4 \\ 7 - x, & x > 4 \end{cases}$$

Example 3: Is $g(x)$ continuous for all values of x?

$$g(x) = \frac{x+3}{x-2}$$

Example 4: Is $h(x)$ continuous for all values of x?

$$h(x) = \frac{x^2-1}{x+1}$$