1. Chapter 2 Section 6: Differentiability

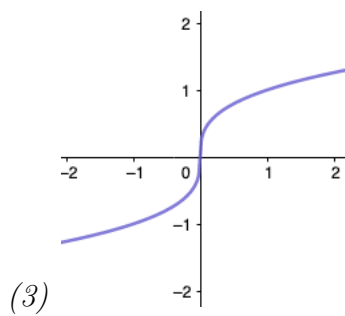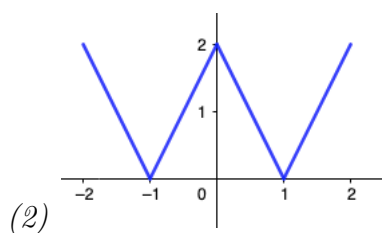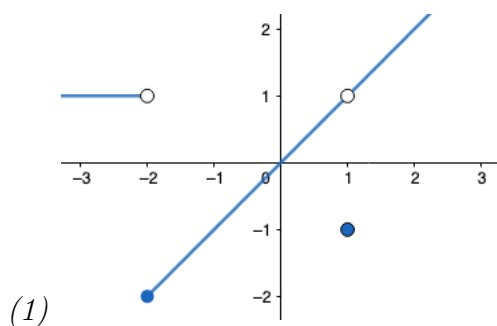**Definition 1.1.** *The function f is* **differentiable** *at $x = a$ if $f'(a) = \lim\limits_{h \to 0} \dfrac{f(a+h) - f(a)}{h}$ is a real number.*

Remark 1.1. *A function is* **not** *differentiable at $x = a$ if...*

(1) *The graph of the function has* _____

(2) *The graph of the function has* _____

(3) *The graph of the function has* _____

2. Examples

Example 2.1 (2.6 WP Homework Question 1, 2; Text 2, 12)**.** *Determine where the functions do* not *appear to be differentiable.*

(1)

(2)

(3)

Example 2.2. *Recall Example 2.1 in the 2.3 course notes: Let $f(x) = \dfrac{1}{x+3}$. Find $f'(x)$ using the definition of the derivative (the difference quotient).*

Use the answer, $f'(x) = \dfrac{-1}{(x+3)^2}$, to find where f is differentiable.

Example 2.3 (2.6 WP Homework Question 4; Text 7, 16)**.** *Use the definition of the derivative to show the function below is not differentiable at $x = 0$.*

$$f(x) = \begin{cases} -2x & \text{if } x < 0 \\ x^2 & \text{if } x \geq 0 \end{cases}$$