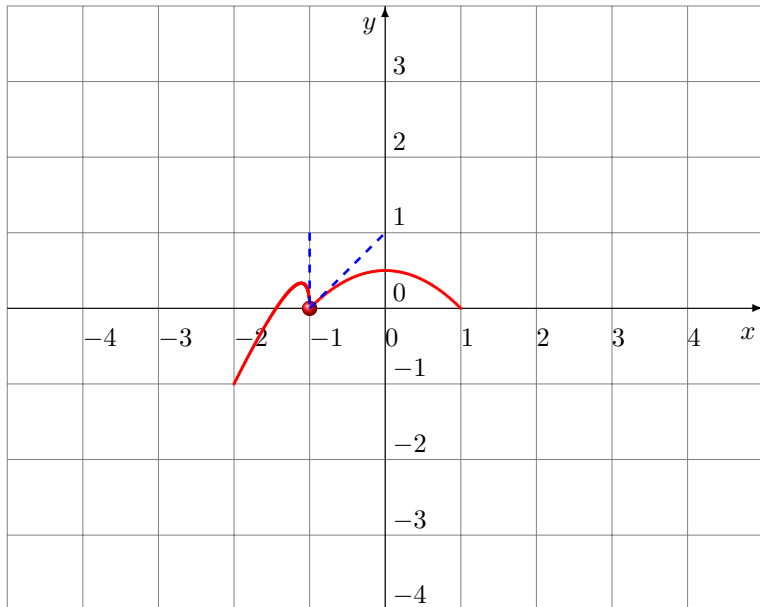
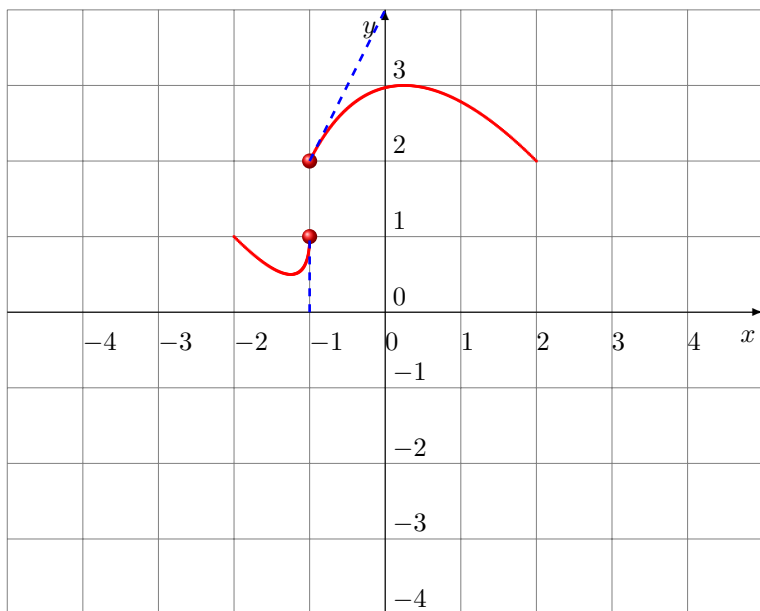


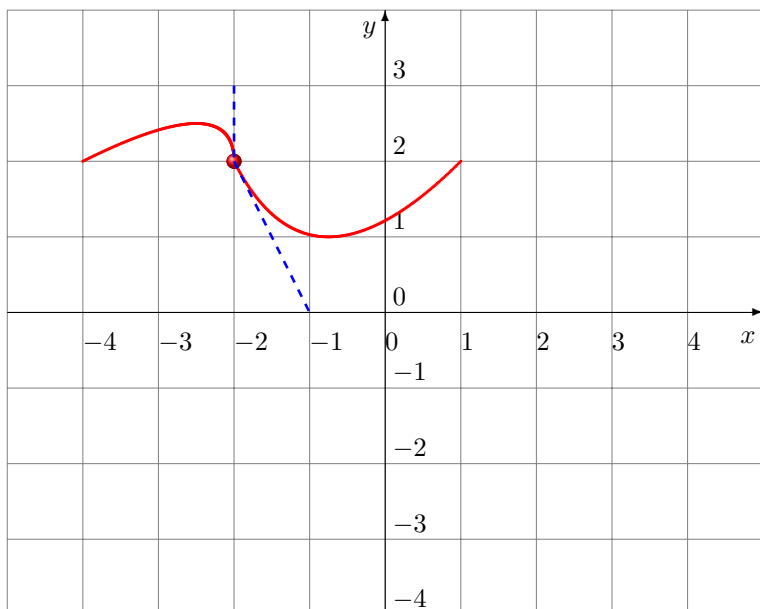
1. Analyze the differentiability of the function represented in the figure below at $x = -1$.



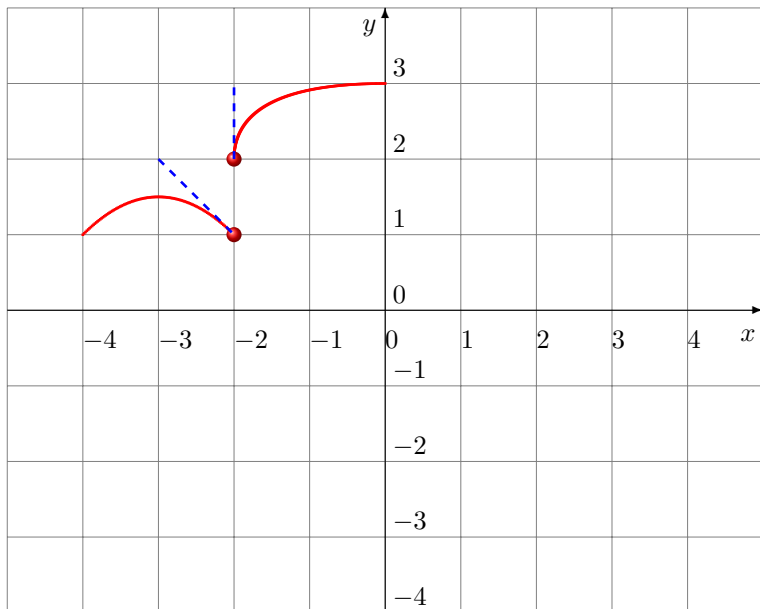
2. Analyze the differentiability of the function represented in the figure below at $x = -1$.



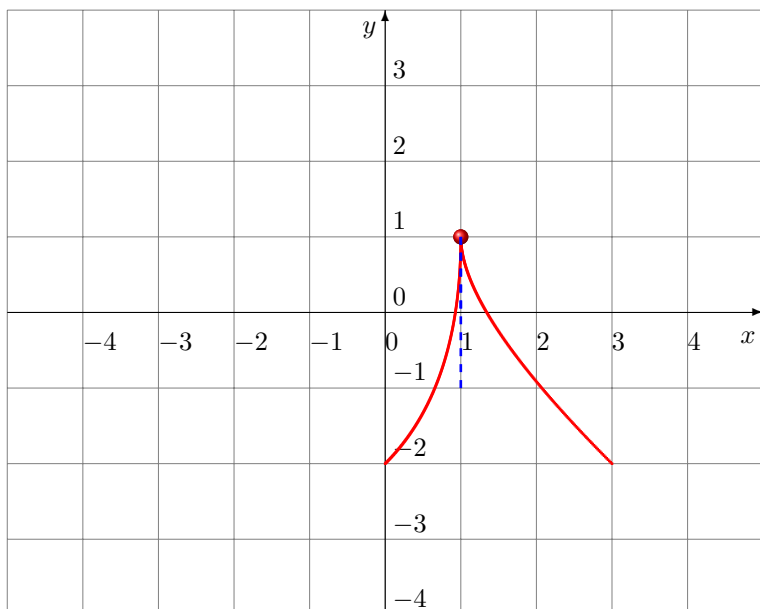
3. Analyze the differentiability of the function represented in the figure below at $x = -2$.



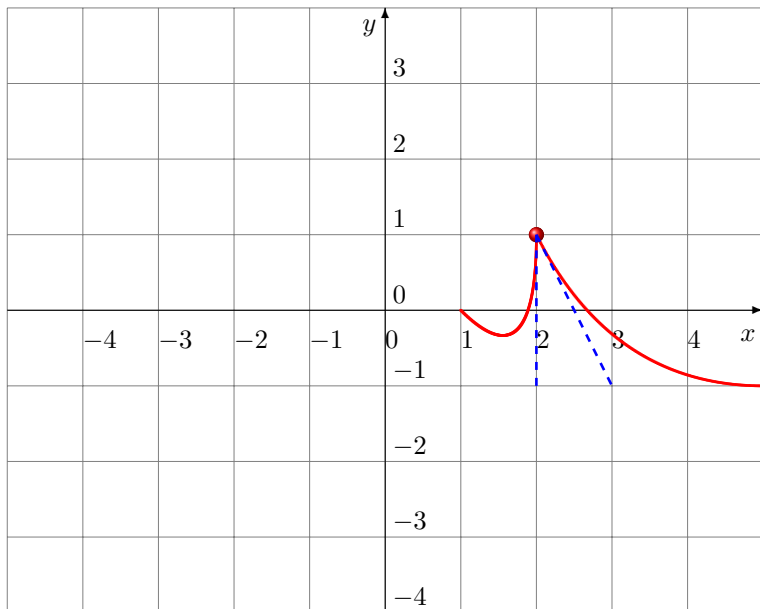
4. Analyze the differentiability of the function represented in the figure below at $x = -2$.



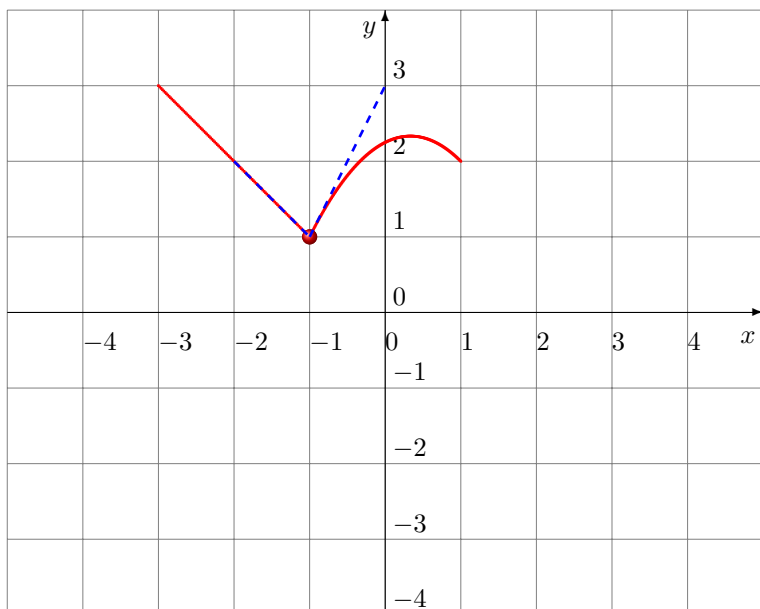
5. Analyze the differentiability of the function represented in the figure below at $x = 1$.



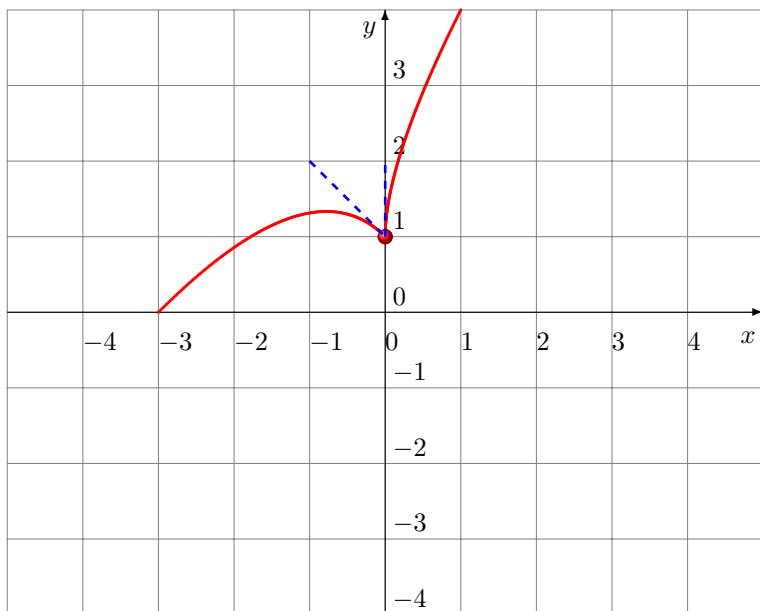
6. Analyze the differentiability of the function represented in the figure below at $x = 2$.



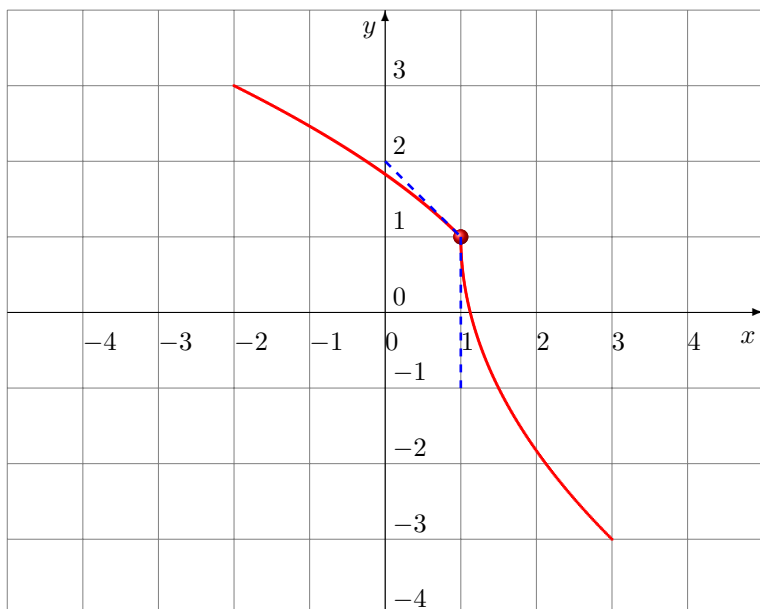
7. Analyze the differentiability of the function represented in the figure below at $x = -1$.



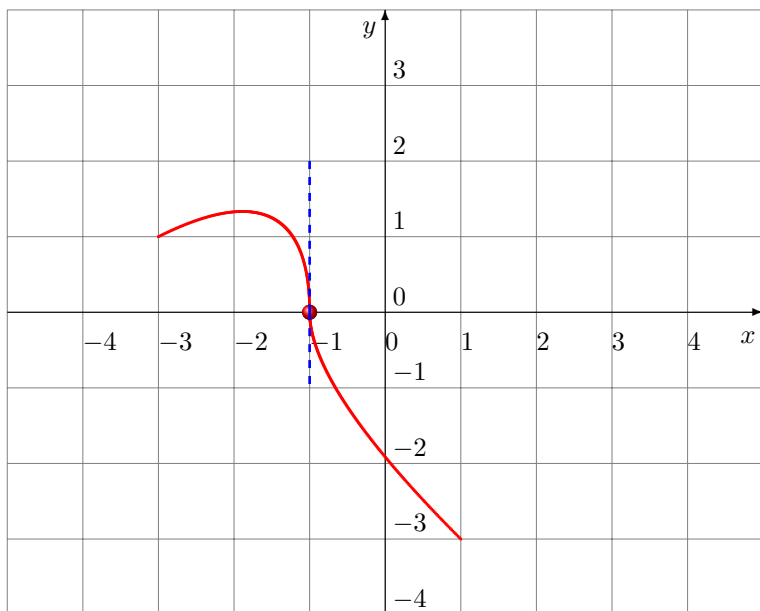
8. Analyze the differentiability of the function represented in the figure below at $x = 0$.



9. Analyze the differentiability of the function represented in the figure below at $x = 1$.

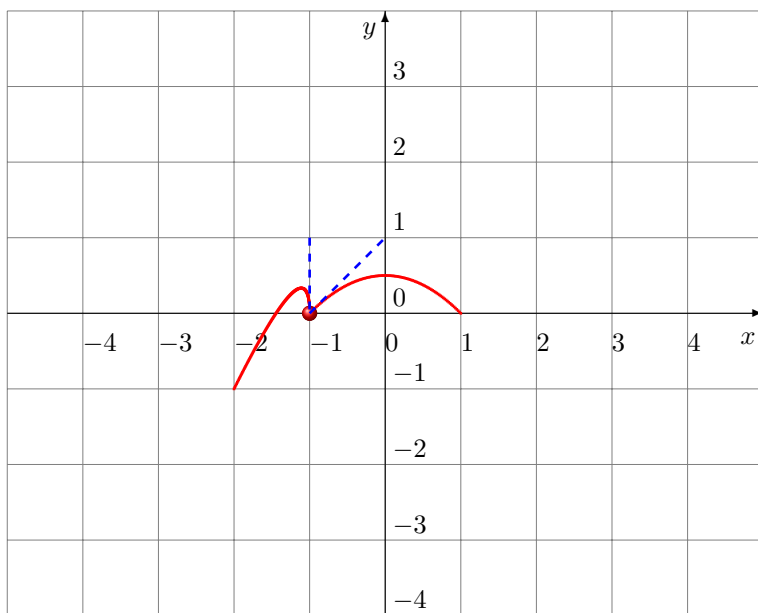


10. Analyze the differentiability of the function represented in the figure below at $x = -1$.



- Answers:
1. non differentiable (corner point)
 2. non differentiable (jump discontinuity)
 3. non differentiable (corner point)
 4. non differentiable (jump discontinuity)
 5. not differentiable (cusp point)
 6. non differentiable (corner point)
 7. non differentiable (corner point)
 8. non differentiable (corner point)
 9. non differentiable (corner point)
 10. not differentiable (infinite slope point)

Solutions: 1.



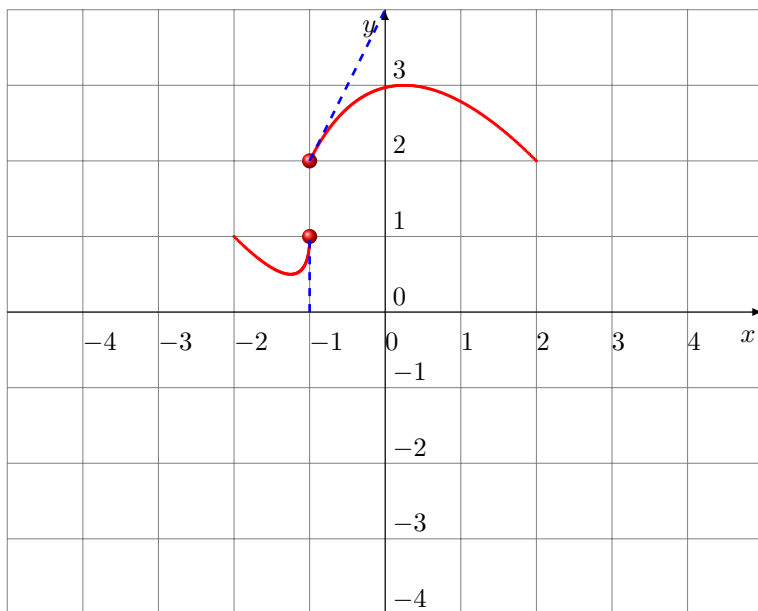
$$\lim_{x \rightarrow -1^-} f(x) = 0 \quad \lim_{x \rightarrow -1^+} f(x) = 0 \quad \lim_{x \rightarrow -1^-} f(x) = \lim_{x \rightarrow -1^+} f(x)$$

∴ The function is continuous at $x = -1$.

$$f'_-(-1) = -\infty \quad f'_+(-1) = 1 \quad f'_-(-1) \neq f'_+(-1)$$

∴ The function is not differentiable. There is a corner point at $x = -1$.

2.

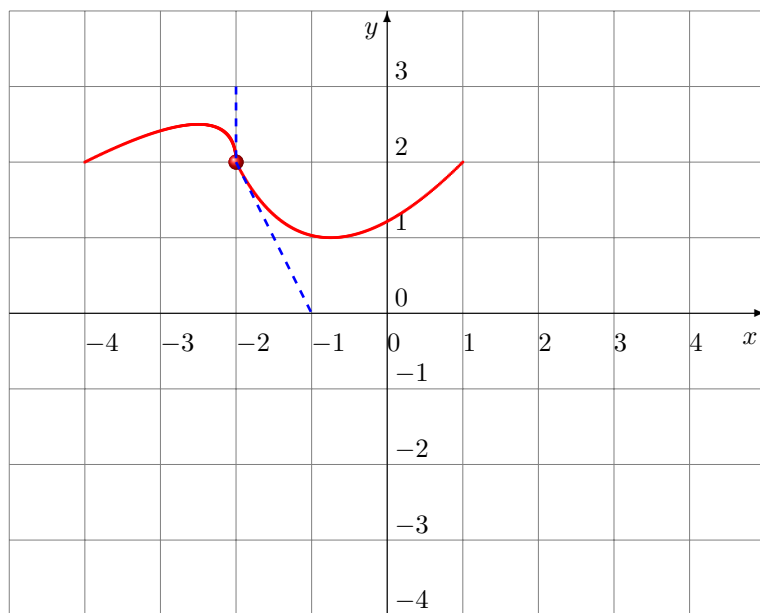


$$\lim_{x \rightarrow -1^-} f(x) = 1 \quad \lim_{x \rightarrow -1^+} f(x) = 2 \quad \lim_{x \rightarrow -1^-} f(x) \neq \lim_{x \rightarrow -1^+} f(x)$$

∴ The function is not continuous. There is a jump discontinuity at $x = -1$

∴ Therefore the function is not differentiable.

3.



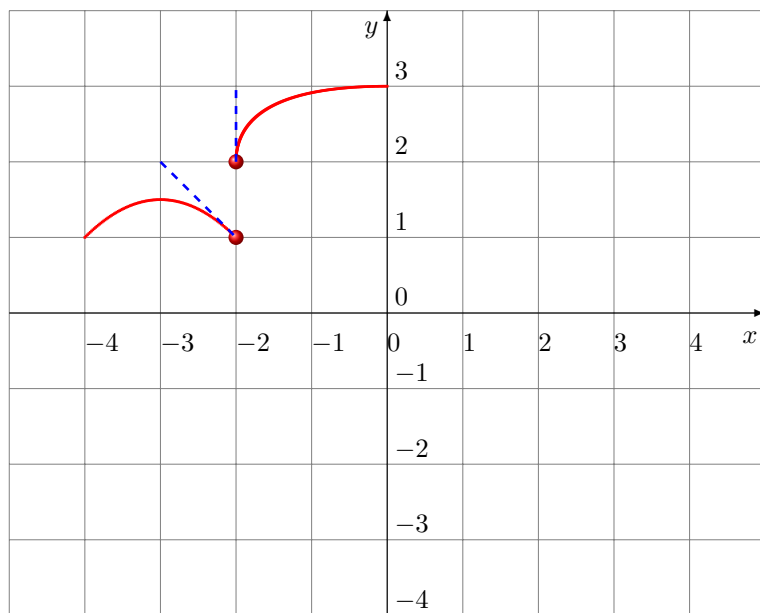
$$\lim_{x \rightarrow -2^-} f(x) = 2 \quad \lim_{x \rightarrow -2^+} f(x) = 2 \quad \lim_{x \rightarrow -2^-} f(x) = \lim_{x \rightarrow -2^+} f(x)$$

∴ The function is continuous at $x = -2$.

$$f'_-(-2) = -\infty \quad f'_+(-2) = -2 \quad f'_-(-2) \neq f'_+(-2)$$

∴ The function is not differentiable. There is a corner point at $x = -2$.

4.

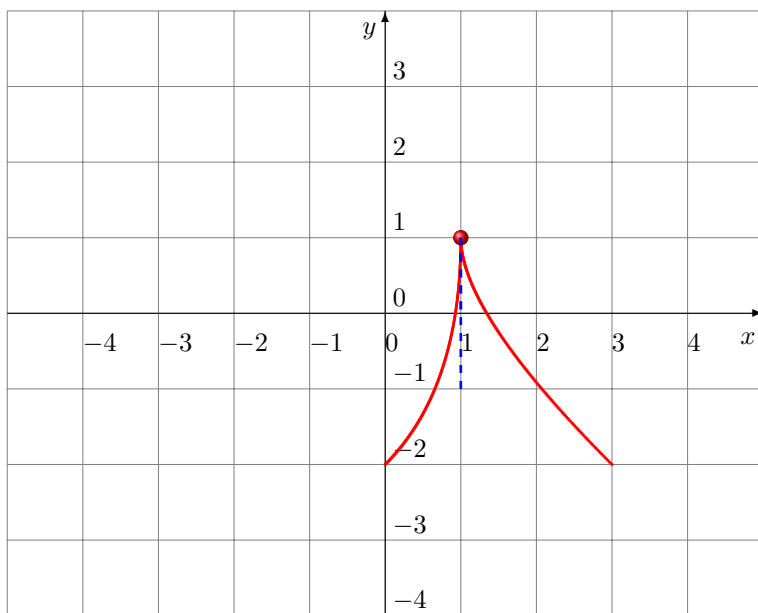


$$\lim_{x \rightarrow -2^-} f(x) = 1 \quad \lim_{x \rightarrow -2^+} f(x) = 2 \quad \lim_{x \rightarrow -2^-} f(x) \neq \lim_{x \rightarrow -2^+} f(x)$$

∴ The function is not continuous. There is a jump discontinuity at $x = -2$

∴ Therefore the function is not differentiable.

5.



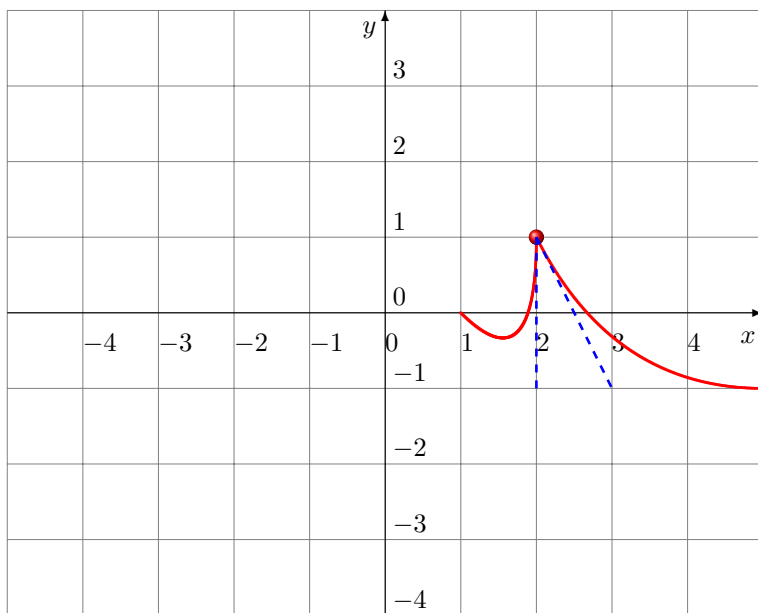
$$\lim_{x \rightarrow 1^-} f(x) = 1 \quad \lim_{x \rightarrow 1^+} f(x) = 1 \quad \lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^+} f(x)$$

∴ The function is continuous at $x = 1$.

$$f'_-(1) = +\infty \quad f'_+(1) = -\infty$$

∴ The function is not differentiable. There is a cusp point at $x = 1$.

6.



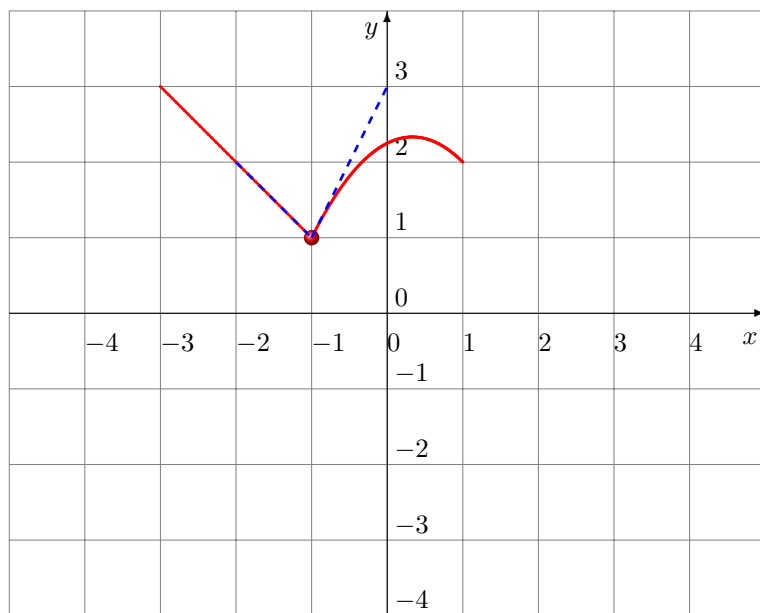
$$\lim_{x \rightarrow 2^-} f(x) = 1 \quad \lim_{x \rightarrow 2^+} f(x) = 1 \quad \lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^+} f(x)$$

∴ The function is continuous at $x = 2$.

$$f'_-(2) = +\infty \quad f'_+(2) = -2 \quad f'_-(2) \neq f'_+(2)$$

∴ The function is not differentiable. There is a corner point at $x = 2$.

7.



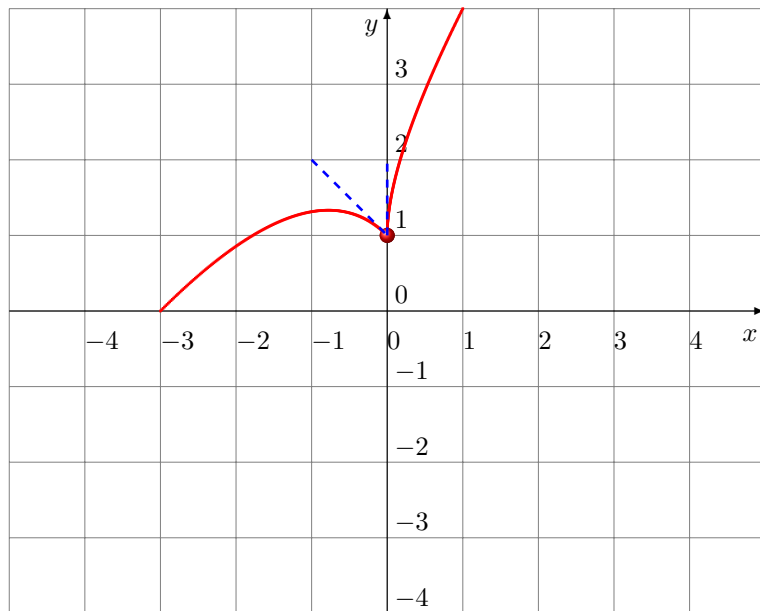
$$\lim_{x \rightarrow -1^-} f(x) = 1 \quad \lim_{x \rightarrow -1^+} f(x) = 1 \quad \lim_{x \rightarrow -1^-} f(x) = \lim_{x \rightarrow -1^+} f(x)$$

∴ The function is continuous at $x = -1$.

$$f'_-(-1) = -1 \quad f'_+(-1) = 2 \quad f'_-(-1) \neq f'_+(-1)$$

∴ The function is not differentiable. There is a corner point at $x = -1$.

8.



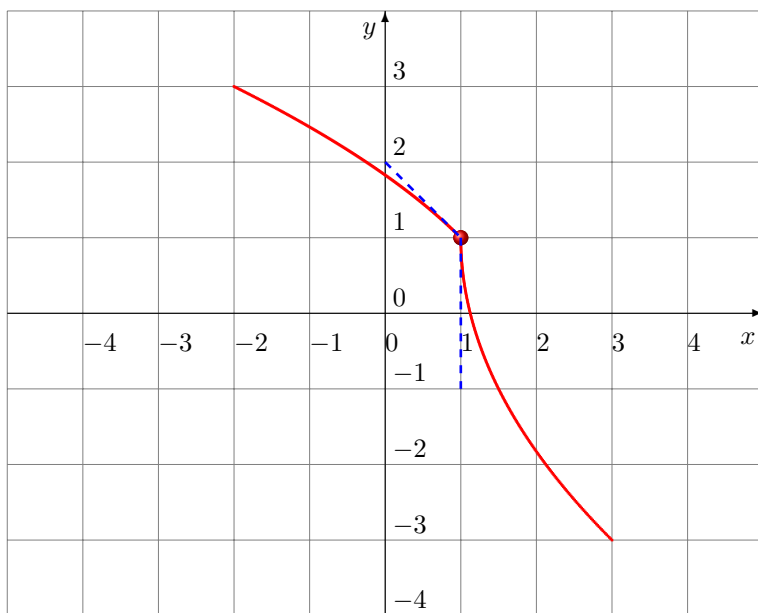
$$\lim_{x \rightarrow 0^-} f(x) = 1 \quad \lim_{x \rightarrow 0^+} f(x) = 1 \quad \lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^+} f(x)$$

∴ The function is continuous at $x = 0$.

$$f'_-(0) = -1 \quad f'_+(0) = +\infty \quad f'_-(0) \neq f'_+(0)$$

∴ The function is not differentiable. There is a corner point at $x = 0$.

9.



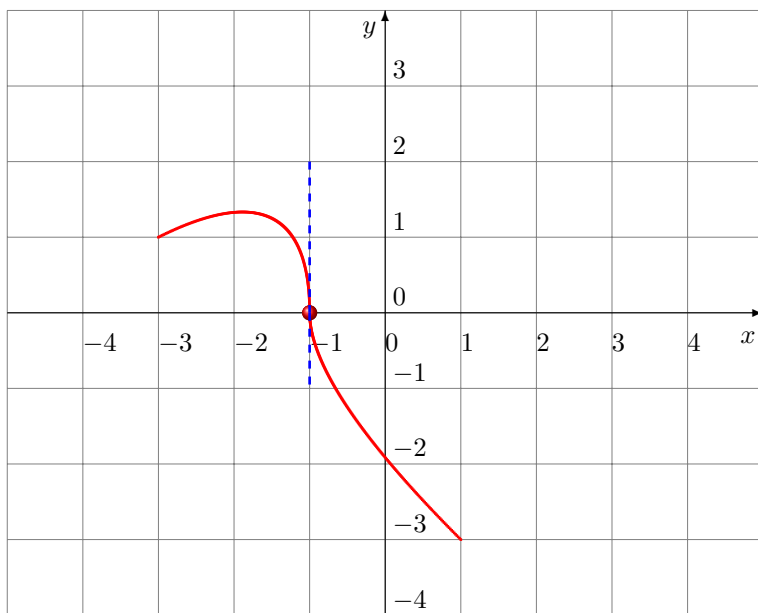
$$\lim_{x \rightarrow 1^-} f(x) = 1 \quad \lim_{x \rightarrow 1^+} f(x) = 1 \quad \lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^+} f(x)$$

∴ The function is continuous at $x = 1$.

$$f'_-(1) = -1 \quad f'_+(1) = -\infty \quad f'_-(1) \neq f'_+(1)$$

∴ The function is not differentiable. There is a corner point at $x = 1$.

10.



$$\lim_{x \rightarrow -1^-} f(x) = 0 \quad \lim_{x \rightarrow -1^+} f(x) = 0 \quad \lim_{x \rightarrow -1^-} f(x) = \lim_{x \rightarrow -1^+} f(x)$$

∴ The function is continuous at $x = -1$.

$$f'_-(-1) = -\infty \quad f'_+(-1) = -\infty$$

∴ The function is not differentiable. There is an infinite slope point $x = -1$.