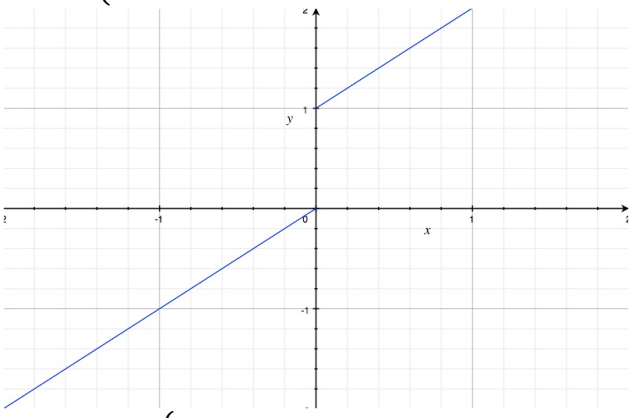
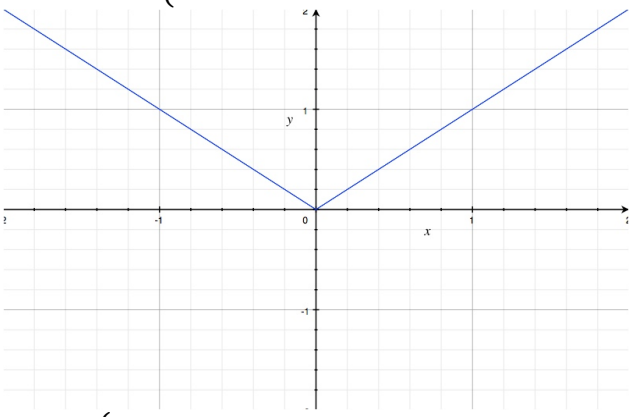
3.2 Working with derivatives

Which of theses functions are differentiable at 0 ? If they are note differentiable, state what condition of the definition is not fulfilled.

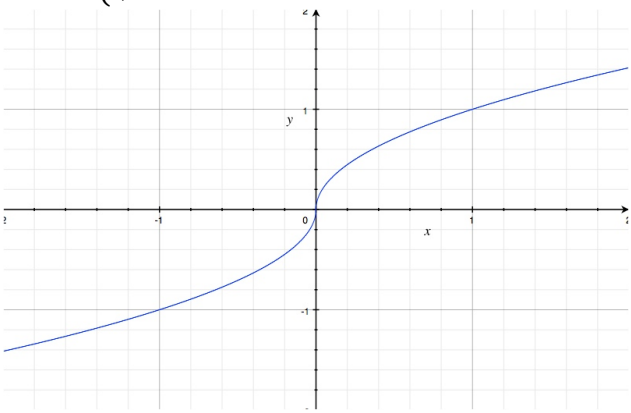
$$f(x) = \begin{cases} x & \text{if } x < 0 \\ x+1 & \text{if } x \geq 0 \end{cases}$$



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



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

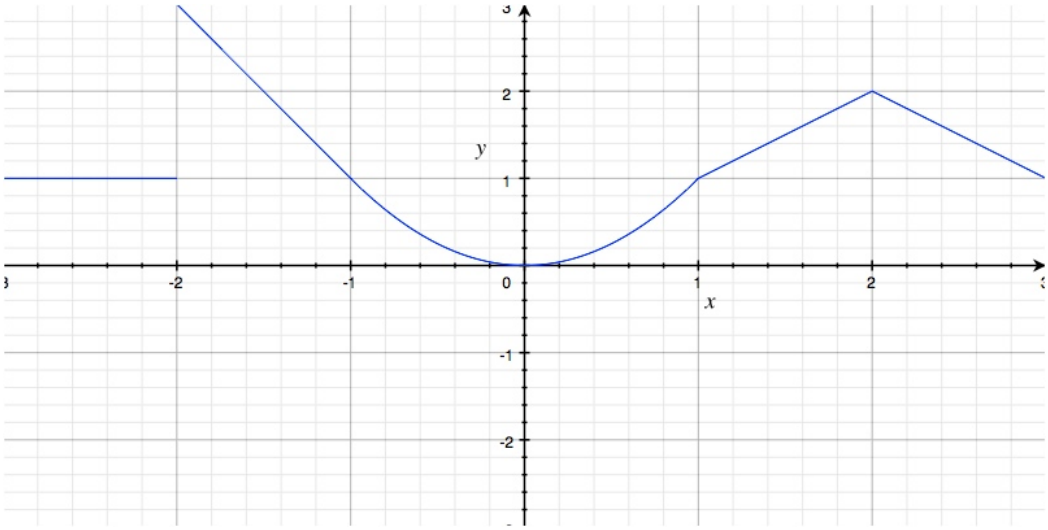


Using the 3 graphs and the definition of the derivative, give the 3 reasons why a function may not be differentiable at some point :

1.
2.
3.

On the following grid, draw the graph of the function f'. The function$f$ (blue graph) is given by

$$f(x) = \begin{cases} 1 & \text{if } x < -2 \\ -2x - 1 & \text{if } -2 \leq x < -1 \\ x^2 & \text{if } -1 \leq x \leq 1 \\ x & \text{if } 1 < x \leq 2 \\ -x + 4 & \text{if } x > 2 \end{cases}$$



What is the derivative of f at 0 ? How is the tangent to f at 0 ?

Complete the following table

$f(x) =$	$f'(x) =$	Monotonicity of f	sign of f'
$3x + 1$			
$-4x - 2$			
x^2			
$\sqrt{x}$			

What can you conjecture ?