

Unit #6: Continuity

Topic: Differentiability

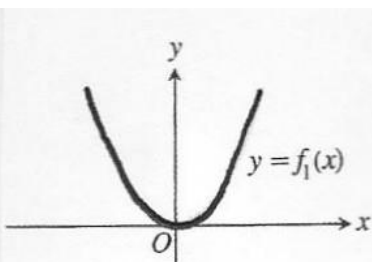
Objective: SWBAT explain why a function is/is not continuous and also differentiable at an indicated point.

## Warm Up #6:

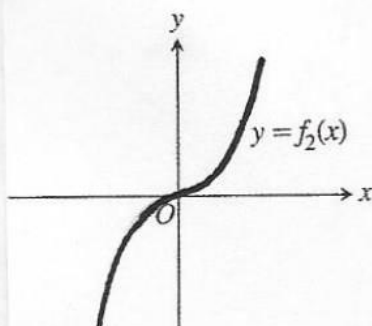
Match the graph of the function with the appropriate graph of the derivative.

$f(x)$

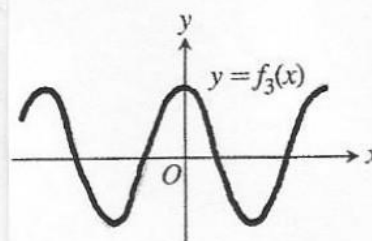
1)



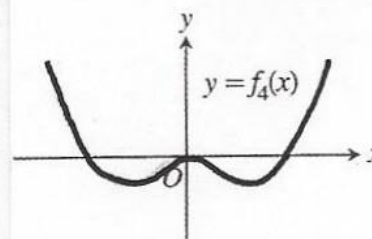
2)



3)

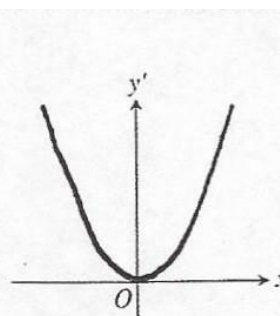


4)

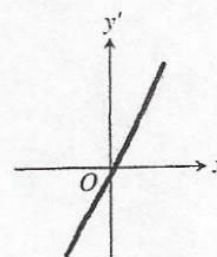


$f'(x)$

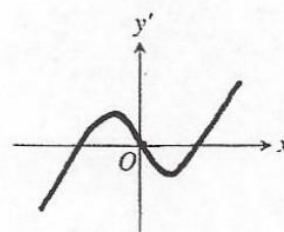
a)



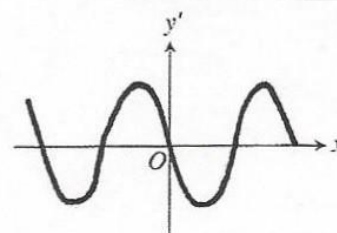
b)



c)



d)



# Differentiability

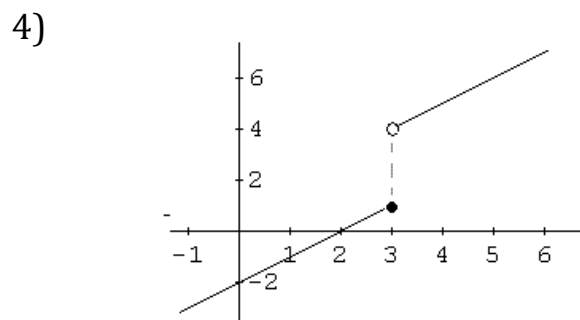
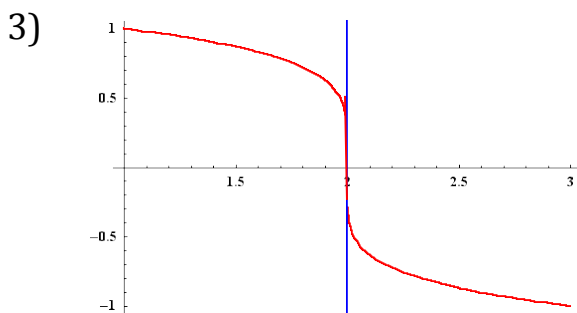
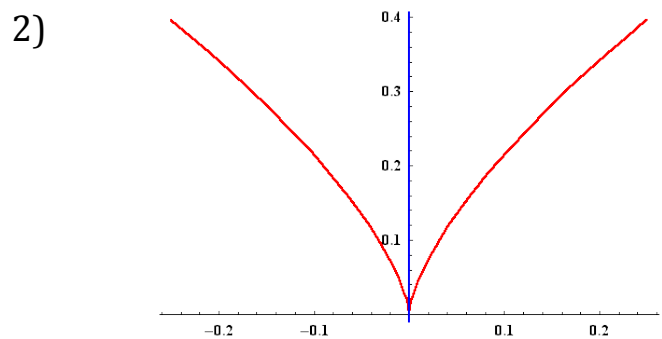
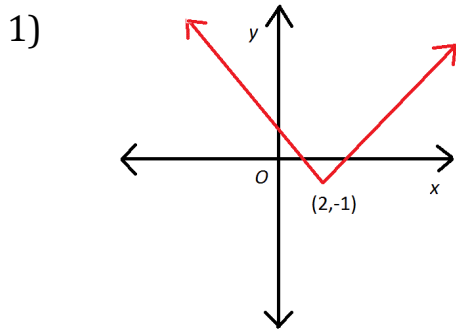
A function may have a left-handed and/or right-handed derivative similarly to the way a function has a left-handed and right-handed limit. In order for the derivative to exist at a point the left and right handed derivatives **MUST** be the same.

*Examples:* Do each of the following functions have a derivative at the given value of  $x$ ?

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

b)  $g(x) = \begin{cases} x^2, & x \leq 0 \\ 2x, & x > 0 \end{cases}$

There are four different instances where a derivative will fail to exist.



Differentiability Implies Continuity:

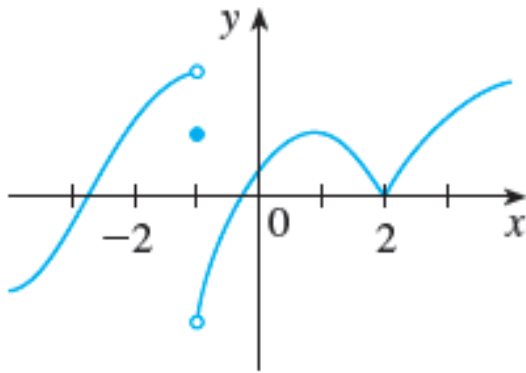
If  $f$  has a derivative at  $x = a$ , then  $f$  is continuous at  $x = a$ .

**BUT**

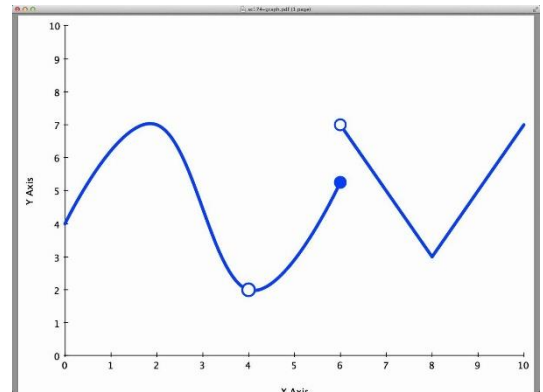
If  $f$  is continuous at  $x = a$  it does not guarantee that  $f$  has a derivative at  $x = a$ .

*Problem Set #6: For each of the following graphs, determine any points where the function is not differentiable. Give a reason for your answer.*

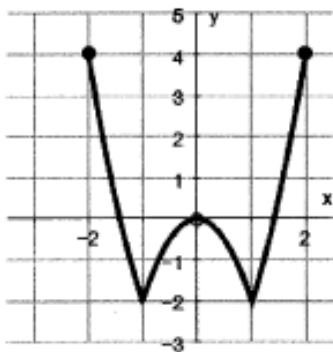
1)



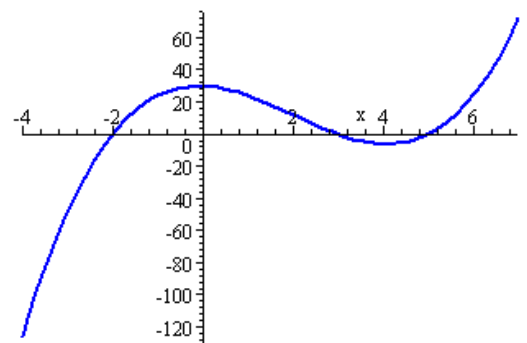
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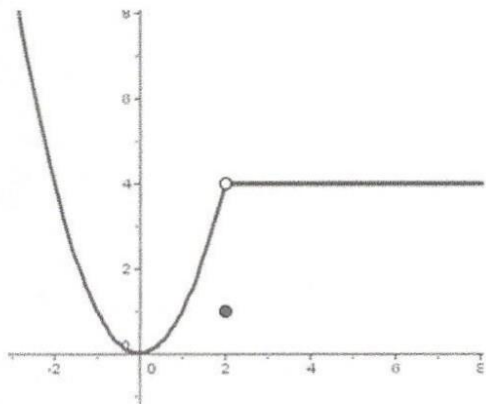
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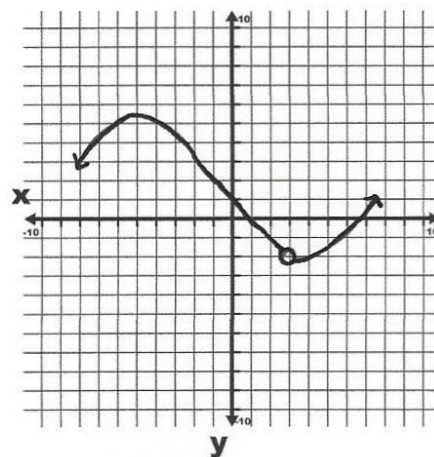
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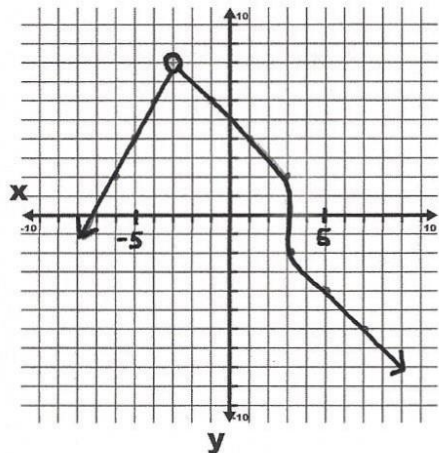
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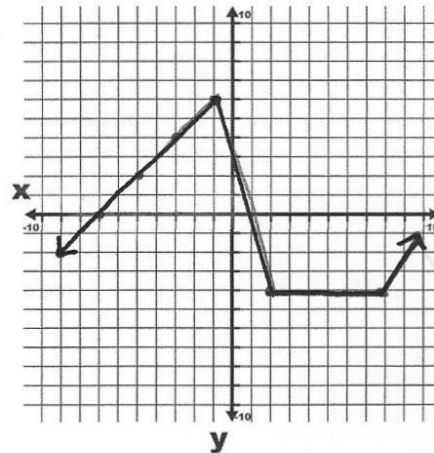
6)



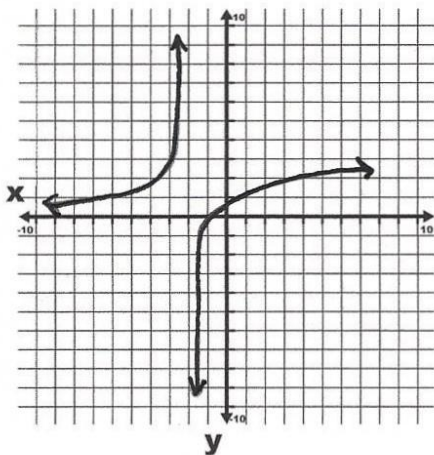
7)



8)



9)



10)

