

DIFFERENTIABILITY

- ✓1) Is $f(x)$ continuous at the specified x -value? Use the definition of continuity to justify your answer.
- ✓2) Sketch the graph of the derivative function $f'(x)$ on the same axes.
- ✓3) Is the derivative function continuous for all x ? If no, state the x -value where discontinuity occurs.
- 4) The graph of $f(x)$ is differentiable everywhere the derivative function exists. State the x -value where $f(x)$ is not differentiable.

<p>1) at $X=0$ $f(x)$ is continuous b/c $f(0) = 0 = \lim_{x \rightarrow 0} f(x)$</p>	<p>at $X=-1$ $f(x)$ is continuous b/c $f(-1) = 1 = \lim_{x \rightarrow -1} f(x)$</p>	<p>at $X=0$ $f(x)$ is continuous b/c $f(0) = \lim_{x \rightarrow 0} f(x) = 0$</p>
<p>3) $f'(x)$ discontinuous at $x=0$</p>	<p>$f'(x)$ is discontinuous at $x=-1$</p>	<p>$f'(x)$ is discontinuous at $x=0$</p>
<p>4) $f(x)$ is not differentiable at $x=0$</p>	<p>$f(x)$ not diff @ $x=-1$</p>	<p>$f(x)$ not diff at $x=0$</p>
<p>1) at $X=0$ $f(x)$ is continuous b/c $f(0) = \lim_{x \rightarrow 0} f(x) = 0$</p>	<p>at $X=0$ $f(x)$ is continuous b/c $f(0) = \lim_{x \rightarrow 0} f(x) = 0$</p>	<p>at $X=0$ $f(x)$ is continuous b/c $f(0) = \lim_{x \rightarrow 0} f(x) = 0$</p>
<p>3) $f'(x)$ is continuous at $x=0$</p>	<p>$f'(x)$ is discontinuous at $x=0$</p>	<p>$f'(x)$ is discontinuous @ $x=0$</p>
<p>4) $f(x)$ is differentiable everywhere</p>	<p>$f(x)$ not diff at $x=0$</p>	<p>$f(x)$ not diff at $x=0$</p>
	<p>What is a pre-requisite for a graph to be differentiable?</p> <p>CONTINUOUS</p> <p>On the graph of $f(x)$ describe 3 characteristics you may see which result in non-differentiability.</p> <p>a sharp point</p> <p>a vertical tangent</p> <p>any discontinuity <small>(hole, jump, asymptote)</small></p>	<p>Write the Definition of Derivative for a function:</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ <p>When does a limit exist?</p> <p>LHL = RHL</p> <p>So in order for a function to be differentiable at a point....</p> <p>LH slope = RH slope</p> <p>Or in other notation:</p> $f'(c^-) = f'(c^+)$
<p>1) at $X=0$ $f(x)$ is not continuous b/c $f(0) = 3$ $\lim_{x \rightarrow 0^-} f(x) = 0$ & $\lim_{x \rightarrow 0^+} f(x) = 3$ $\therefore \lim_{x \rightarrow 0} f(x)$ dne</p>		
<p>3) $f'(x)$ is discontinuous at $x=0$</p>		
<p>4) $f(x)$ not diff @ $x=0$</p>		

If a function is differentiable at a point, then the function is always continuous at that point.

If a function is continuous at a point, then the function is only sometimes differentiable at that point.