Lesson 1.4: Differentiability

Differentiable functions:

A function is said to be differentiable at *a* if $f'(a)$ exists. In other words the $\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$ must exit.

Sketch three possible graphs of functions that are not differentiable at a point.

Note worth mentioning: If a function is differentiable at *x = a*, then it must also be continuous at *x = a*. the opposite is not true.

Example 1: Determine if the following function is differentiable and continuous at *x = 0*.

a) $f(x) = |x|$

Practice:

1. Determine if the following function is differentiable and continuous at *x = 0.*

$$f(x) = \frac{1}{x^2}$$

2. For the function $f(x) = x\,|x|$, show that *f'(0)* exists. What is the value?

3. Does the function $f(x) = x^3$ ever have a negative slope? If so, where? Give reasons for your answer.

4. Give an example of a function that is continuous on $-\infty < \mathrm{x} < +\infty$ but is not differentiable at *x = 3*.