MATH 12002 **DERIVATIVES** **Section 2.2**

- The **derivative of a function** f **at a number** a, denoted by $f'(a)$ is

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

if this limit exists.

- **Other notations for the derivative**

$$f'(x) = y' = \frac{dy}{dx} = \frac{df}{dx} = \frac{d}{dx}f(x) = Df(x) = D_x f(x)$$

and

$$f'(a) = \left.\frac{dy}{dx}\right|_{x=a}$$

- A function f is **differentiable at** a if $f'(a)$ exists. It is **differentiable on an open interval** (a, b) (or $(a, \infty), (-\infty, a)$, or $(-\infty, \infty)$) if it is differentiable at every number in the interval.

- **Theorem:** If f is differentiable at a, then f is continuous at a.

- The converse of the above theorem is NOT true.

- A function f is not differentiable at $x = a$ if

  1. the graph of the function f has a corner, kink, or sharp point at $x = a$.

  2. the function f is not continuous at $x = a$.

  3. the function f has a vertical tangent line at $x = a$