Calculus 3.4 Key Points

Antiderivatives:
The antiderivative of a function is a function that, when differentiated, is the original function.
In other words, it is the reverse of a derivative.

Antiderivatives are denoted by a capital letter (The antiderivative of $f(x)$ is $F(x)$)

NOTE: Remember to add "$+ C$" when taking an antiderivative

- The derivative of $f(x) = x^2 + 1$ and $f(x) = x^2 + 6$ are both $f'(x) = 2x$. Thus, if you were given the function $f(x) = 2x$, reversing the derivative could get you $F(x) = x^2 + 1$, $F(x) = x^2 + 6$, $F(x) = x^2 + 50$, or an infinite amount of other functions where a constant is added to the end. Thus, to show these possibilities, we would write the antiderivative as $F(x) = x^2 + C$

Differentiability:

For a function $f(x)$ to be differentiable at $x = c$,

- It must be continuous at $x = c$
- $\lim_{x \to c} f'(x)$ must exist
    - This means that the slope of $f(x)$ must approach the same value from the left and right sides of $x = c$

Examples of points where a function is non-differentiable:

- Endpoints
- Discontinuities (Jump, Hole, Asymptote)
- Cusps
- Vertical tangents