5.4 Indefinite Integral and the Net change Theorem

First I will distinguish between

$\int_a^b f(x)\,dx$ vs $\int f(x)\,dx$ where $\int f(x)\,dx = F(x)$

5.1 5.2 5.3 - Definite integral
- area under the curve $y=f(x)$
- It is a number

- Indefinite integral
- It is a function

and $F'(x) = f(x)$

$\frac{d}{dx}\left(\frac{x^3}{3}+C\right) = x^2$ (antiderivative, derivative)

(more elegant) $\int x^2\,dx = \frac{x^3}{3} + C$

Table of Indefinite integrals

1. $\int c f(x)\,dx = c\int f(x)\,dx$
2. $\int k\,dx = kx + C$
3. $\int x^n\,dx = \frac{x^{n+1}}{n+1} + C \quad (n \neq -1)$
4. $\int e^x\,dx = e^x + C$
5. $\int \sin(x)\,dx = -\cos(x) + C$
6. $\int \sec^2(x)\,dx = \tan(x) + C$
7. $\int \sec(x)\tan(x)\,dx = \sec(x) + C$
8. $\int \frac{1}{1}\,dx = \tan^{-1}(x) + C$

Recall $d\left(\tan^{-1}(x)\right) = \frac{1}{1}$

(8) $\int \frac{1}{x^2+1}\,dx = \tan^{-1}(x) + C$

Recall $\frac{d}{dx}\left(\tan^{-1}(x)\right) = \frac{1}{x^2+1}$

(9) $\int \sinh(x) = \cosh(x) + C$

(10) $\int \frac{1}{x}\,dx = \ln|x| + C$

(11) $\int b^x\,dx = \frac{b^x}{\ln(b)} + C$

(12) $\int \cos(x)\,dx = \sin(x) + C$

(13) $\int \csc(x)\,dx = -\cot(x) + C$

(14) $\int \csc(x)\cot(x)\,dx = -\csc(x) + C$

(15) $\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1}(x) + C$

(16) $\int \cosh(x)\,dx = \sinh(x) + C$