Antiderivatives

Thinking Backards

- As we learned in the lab, mathematicians like to be able to work backwards
- So, we would like to be able to undo our derivatives
- When asked to find an antiderivative of F(x) we just need to think, "What function f(x) would F(x) = f'(x)?

$$\left(\frac{d}{dx}\right)^{-1} F(x) = \int F(x)\,dx$$

Examples

$$\int 0\,dx \qquad \int e^{x}\,dx \qquad \int \sin(x)\,dx \qquad \int \cos(x)\,dx$$

$$\int x\,dx \qquad \int e^{3x}\,dx \qquad \int 2\sin(3x)-3\cos(2x)\,dx$$

$$\int x^{2}\,dx \qquad \int 5e^{3x}\,dx \qquad \int \frac{1}{x}\,dx \qquad \int \frac{5}{x}\,dx$$

$$\int x^{n}\,dx \qquad \int n^{x}\,dx \qquad \int x\sin(x^{2})\,dx$$

$$\int n\,f(x)\,dx \qquad \int e^{x^{2}}\,dx$$

$$\int f(x)+g(x)\,dx$$

Initial Value Problems

- A problem when we are given the rate of change of a function and a starting point
- Example:
  - $f'(x) = \sin(8x)$ and $f(0) = 0$
  - This means the $f(x) = -1/8 \cos(8x) + C$
  - Since we know $f(0) = -1/8 \cos(8 (0)) + C = 0$
  - $1/8 \cos(0) = C$
  - $C = 1/8$
  - $f(x) = -1/8 \cos(8x) + 1/8$

Questions?