

$$e^{-x^2} \rightarrow 0 \text{ as } x \rightarrow \infty \quad \frac{1}{4}$$



$$f(x) = e^x \quad \frac{df}{dx} = \frac{d}{dx}(e^x) = e^x$$

$$\lim_{x \rightarrow \infty} e^{-x^2} \cdot \sin x = 0$$

Example:

$$\frac{d}{dx}(e^{u(x)}) = e^{u(x)} u'(x)$$

$$e^{-x^2} \rightarrow e^0 \text{ as } x \rightarrow \infty$$

$$e^{x^2-1} = e^{-x^2} \cdot \sin x = e^{-x^2} \cdot 1$$

$$\textcircled{1} \lim_{x \rightarrow \infty} e^{-x^2} \sin x \text{ DNE}$$

$$\textcircled{2} \int e^{ax} dx = \frac{1}{a} e^{ax} + C \quad \frac{d}{dx}(e^{ax}) = e^{ax} \cdot a$$

$$\textcircled{3} \int x e^{x^2} dx = \frac{1}{2} \int e^u du \quad \text{let } u = x^2, \quad du = 2x dx, \quad \frac{1}{2} du = x dx$$

$$= \frac{1}{2} e^u + C = \frac{1}{2} e^{x^2} + C$$

$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

$$\int \frac{1}{x} dx = \ln|x| + C$$

$$\textcircled{4} \int \frac{e^x}{1+e^x} dx = \int \frac{du}{u} \quad \text{let } u = 1+e^x, \quad du = e^x dx$$

$$= \ln|u| + C = \ln|1+e^x| + C = \ln(1+e^x) + C$$

$$\textcircled{5} \frac{e^x}{e^x} \int \frac{1}{1+e^{-x}} dx$$

$$= \int \frac{e^x dx}{e^x + 1}$$

$$e^{\ln x} = x$$

§6.4.

exponential function $f(x) = a^x = e^{\ln a^x} = e^{x \ln a}$

$$\frac{d}{dx}(a^x) = \frac{d}{dx}(e^{x \ln a}) = e^{x \ln a} \ln a = a^x \ln a$$

$$\ln x = \log_e x$$

logarithmic function $f(x) = \log_b x = \frac{\ln x}{\ln b}$

$$y = \log_b x \quad \frac{d}{dx}(\log_b x) = \frac{d}{dx}\left(\frac{\ln x}{\ln b}\right) = \frac{1}{x} \frac{1}{\ln b}$$

$$\Rightarrow b^y = x \Rightarrow \ln(b^y) = \ln x \Rightarrow y \ln b = \ln x \Rightarrow y = \frac{\ln x}{\ln b}$$