Sec 5.4 Exponential Functions

THEOREM 5.12 INTEGRATION RULES FOR EXPONENTIAL FUNCTIONS

Let u be a differentiable function of x.

1. $\int e^x\,dx = e^x + C$ 2. $\int e^u\,du = e^u + C$

$\frac{1}{3}\int e^{3x+1}\,3\,dx$

$u = 3x+1$

$du = 3\,dx$

$\frac{1}{3}\left[\int e^u\,du\right] = e^u + C$

$= \frac{1}{3}e^{3x+1} + C$

ex. $\int 5xe^{-x^2}\,dx$

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

$u = -x^2$

$du = -2x\,dx$

$-\frac{5}{2}\int e^u\,du$

$-\frac{5}{2}e^u + C = -\frac{5}{2}e^{-x^2} + C$

$= -\frac{5}{2}\left(\frac{1}{e^{x^2}}\right) + C = \frac{-5}{2e^{x^2}} + C$

$-x^2 \neq (-x)^2$ ($-(x)^2$)

$e^{-x} = \frac{1}{e^x}$

$e^{-x^2} = \frac{1}{e^{x^2}}$

$$\int a^x\,dx = \left(\frac{1}{\ln a}\right)a^x + C$$

ex. $\int 4^x\,dx = \frac{1}{\ln 4}\,4^x + C = \frac{4^x}{\ln 4} + C$

ex. $\frac{1}{2}\int 6^{2x}\,2\,dx$

$u = 2x$

$du = 2\,dx$

$\frac{1}{2}\int 6^u\,du = \frac{1}{2}\left(\frac{1}{\ln 6}\right)6^u + C = \frac{6^{2x}}{2\ln 6} + C$

$= \frac{6^{2x}}{\ln 36} + C$

Princeton book p. 335 7-12 all