CALC. 1/1

CALCULUS REVIEW

INTEGRATION: POLYNOMIALS, e^x, SUBSTITUTION RULE, BY PARTS $\int xe^x dx$

DIFFERENTIATION: POLYNOMIALS, e^x, CHAIN RULE

INTEGRATION

POLYNOMIAL: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

EX $\int_0^1 x^5 = \frac{x^6}{6}\Big|_0^1 = \frac{1^6}{6} - \frac{0^6}{6} = \frac{1}{6}$

e^x:

EX $\int e^x dx = e^x + C$

SUBSTITUTION:

EX $\int_0^1 (3x+4)^5 dx$ $\quad u = 3x+4$

$\downarrow$ $\quad du = 3dx \Rightarrow dx = \frac{1}{3}du$

$\int_0^1 u^5 \frac{1}{3} du = \frac{1}{3}\frac{u^6}{6} = \frac{(3x+4)^6}{18}\Big|_0^1 = \frac{7^6}{18} - \frac{4^6}{18}$

EX $\int e^{-3x} dx$ $\quad u = -3x$

$\downarrow$ $\quad du = -3dx \Rightarrow dx = -\frac{1}{3}du$

$\int e^u (-\frac{1}{3}) du = -\frac{1}{3}e^u + C = -\frac{1}{3}e^{-3x} + C$

EX $\int x e^{-x^2} dx$ $\quad u = -x^2$

$\downarrow$ $\quad du = -2x\,dx \Rightarrow x\,dx = -\frac{1}{2}du$

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

CHECK: $\frac{d}{dx}(-\frac{1}{2}e^{-x^2}) = (-\frac{1}{2}e^{-x^2})\frac{d}{dx}(-x^2) = -\frac{1}{2}e^{-x^2}(-2x) = xe^{-x^2}$

BY PARTS: $\int u\,dv = uv - \int v\,du$

EX $\int xe^{-x}dx$, PICK $\quad u = x \quad dv = e^{-x}dx$

$du = 1\,dx \quad v = -e^{-x}$

$\int xe^{-x}dx = -xe^{-x} - \int -e^{-x}(1)\,dx = -xe^{-x} + \int e^{-x}dx = -xe^{-x} - e^{-x} + C$

DIFFERENTIATION

POLY $\frac{d}{dx}x^n = nx^{n-1}$, $\frac{d}{dx}e^x = e^x$, $\frac{d}{dx}(f(x)g(x)) = f'(x)g(x) + f(x)g'(x)$.