201-SH3-AB - Exercises #9: Integration By Parts

Part I: Evaluate the following indefinite integrals using integration by parts.

(1) $\int_0^1 2(2x-1)e^{2x}\ dx$

(2) $\int (x^2+4)e^{-x}\ dx$

(3) $\int 18x^2 \ln(2x)\ dx$

(4) $\int (6x-5)\ln(2x)\ dx$

(5) $\int \frac{\ln(4x)}{x^4}\ dx$

(6) $\int (x+2)^2\, e^{3x}\ dx$

(7) $\int (24x^2 - 72x)\ln(3x)\ dx$

(8) $\int (3x-x^2)e^{-2x}\ dx$

(9) $\int (12x^2 - 36x)\ln(2x)\ dx$

(10) $\int (8x-1)\cos(2x)\ dx$

(11) $\int 6(x^2-1)\sin(2x)\ dx$

(12) $\int (x^3+x)\sin(3x)\ dx$

Part II: Evaluate the following definite integrals using integration by parts.

(13) $\int_0^{\ln 3} xe^x\ dx$

(14) $\int_0^2 xe^{-x}\ dx$

(15) $\int_1^4 3\ln x\ dx$

(16) $\int_1^2 x\ln x\ dx$

(17) $\int_1^{e^2} \frac{\ln x}{\sqrt{x}}\ dx$

(18) $\int_0^1 (1-x^2)e^{x/3}\ dx$

(19) $\int_0^2 (2x+1)\ln(x+1)\ dx$

(20) $\int_0^1 (x-1)^2 \cos(\pi x)\ dx$

(21) $\int_0^{\pi/3} (3-x)\cos(2x)\ dx$

(22) $\int_0^{\pi/6} (2-5x)\sin(3x)\ dx$

ANSWERS:

(1) 2

(2) $-e^{-x}(x^2 + 2x + 6) + C$

(3) $6x^3 \ln(2x) - 2x^3 + C$

(4) $(3x^2 - 5x)\ln(2x) - \frac{3}{2}x^2 + 5x + C$

(5) $-\frac{\ln(4x)}{3x^3} - \frac{1}{9x^3} + C$

(6) $\frac{e^{3x}}{27}(9x^2 + 30x + 26) + C$

(7) $(8x^3 - 36x^2)\ln(3x) - \frac{8}{3}x^3 + 18x^2 + C$

(8) $\frac{e^{-2x}}{2}(x^2 - 2x - 1) + C$

(9) $(4x^3 - 18x^2)\ln(2x) - \frac{4}{3}x^3 + 9x^2 + C$

(10) $\frac{1}{2}(8x - 1)\sin(2x) + 2\cos(2x) + C$

(11) $3(1 - x^2)\cos(2x) + 3x\sin(2x) + \frac{3}{2}\cos(2x) + C$

(12) $-\frac{1}{3}(x^3 + x)\cos(3x) + \frac{1}{27}(9x^2 + 1)\sin(3x) + \frac{2}{9}x\cos(3x) + C$

(13) $3\ln 3 - 2$

(14) $1 - 3/e^2$

(15) $3(4\ln 4 - 3)$

(16) $2\ln 2 - 3/4$

(17) 4

(18) $51 - 36\sqrt[3]{e}$

(19) $6\ln 3 - 2$

(20) $2/\pi^2$

(21) $\frac{3\sqrt{3}}{4} + \frac{3}{8} - \frac{\pi\sqrt{3}}{12}$

(22) $\frac{1}{9}$