201-SH3-AB - Exercises #10 - Mixed Integrals

Part I: Evaluate the following indefinite integrals.

(1) $\displaystyle\int_1^e \frac{\ln x}{x}\,dx$

(2) $\displaystyle\int (2x^2+1)e^{4x^3+6x}\,dx$

(3) $\displaystyle\int \frac{\cos\sqrt{x}}{\sqrt{x}}\,dx$

(4) $\displaystyle\int x\ln(2x-1)\,dx$

(5) $\displaystyle\int \frac{3\sqrt{t}-3+t\cos(2t)}{2t}\,dt$

(6) $\displaystyle\int \frac{5x^3\sin x+\sqrt{x}-10}{x^3}\,dx$

(7) $\displaystyle\int \frac{e^{\sqrt{x+1}}}{\sqrt{x+1}}\,dx$

(8) $\displaystyle\int (x^3+2)\sin(x^4+8x)\,dx$

(9) $\displaystyle\int (t^2+1)e^{t^3+3t}\,dt$

(10) $\displaystyle\int \frac{x+2}{\sqrt{x^2+4x+9}}\,dx$

(11) $\displaystyle\int \frac{e^{-2x}}{\sqrt{3e^{-2x}+1}}\,dx$

(12) $\displaystyle\int 2x\ln(3x)\,dx$

(13) $\displaystyle\int \left(\cos x+5^x+\sqrt{4x}-e^5\right)\,dx$

(14) $\displaystyle\int \frac{x(2-\sqrt{x})+x^2\sec^2 x}{x^2}\,dx$

(15) $\displaystyle\int \sin(2x)\sqrt[3]{2+\cos(2x)}\,dx$

(16) $\displaystyle\int \frac{dx}{x\ln(2x)}$

(17) $\displaystyle\int \frac{3\sqrt[4]{x}+6\sqrt[3]{x^5}-4x^2}{2\sqrt{x}}\,dx$

(18) $\displaystyle\int (3x^2-1)e^{4x}\,dx$

(19) $\displaystyle\int (3x+2)^2\cos(5x)\,dx$

(20) $\displaystyle\int \frac{\sin x\cos x}{\sqrt[3]{\sin^2 x+7}}\,dx$

(21) $\displaystyle\int 3x^2\sin x\,dx$

(22) $\displaystyle\int \frac{(\ln x+1)^2}{3x}\,dx$

(23) $\displaystyle\int \frac{(1+\sqrt{x})^5}{\sqrt{x}}\,dx$

(24) $\displaystyle\int x2^x\,dx$

(25) $\displaystyle\int \ln(2x)\,dx$

Part II: Evaluate the following definite integrals.

(26) $\displaystyle\int_0^3 \frac{18e^{3x}}{e^{3x}+2}\,dx$

(27) $\displaystyle\int_1^2 \frac{4x^3e^{x^2-1}+6}{x^2}\,dx$

(28) $\displaystyle\int_0^1 56x^3(x^4-1)^6\,dx$

(29) $\displaystyle\int_0^{\pi/16} \left(12\sec^2(4x)-6e^{2x}\right)\,dx$

(30) $\displaystyle\int_0^1 \frac{16x^3}{(1+x^4)^2}\,dx$

(31) $\displaystyle\int_{\frac{1}{3}}^1 (1-6x)\ln x\,dx$

(32) $\displaystyle\int_\pi^{2\pi} x^2\sin(x/2)\,dx$

(33) $\displaystyle\int_0^1 \left(\frac{4\ln(x+1)}{x+1}+2e^{2x}\right)\,dx$

(34) $\displaystyle\int_0^{\ln(2)} \frac{6(e^{3x}+1)}{e^{3x}+3x}\,dx$

(35) $\displaystyle\int_0^{\ln 2} (x+1)e^x\,dx$

(36) $\displaystyle\int_2^3 \frac{2(x^3-1)}{(2x^4-8x)^2}\,dx$

(37) $\displaystyle\int_0^{\ln(2)} \frac{\ln(1+e^x)}{1+e^x}e^x\,dx$

(38) $\displaystyle\int_0^1 10x\sqrt[3]{(1-x^2)^2}\,dx$

(39) $\displaystyle\int_{-1}^0 \frac{24(2x+x^3)}{(1-4x^2-x^4)^2}\,dx$

(40) $\displaystyle\int_1^e \frac{6}{x(4+3\ln(x))^2}\,dx$

(41) $\displaystyle\int_0^1 9e^{3x}\sqrt{e^{3x}+3}\,dx$

(42) $\displaystyle\int_0^1 (9x-3)e^{3x^2-2x}\,dx$

(43) $\displaystyle\int_0^\pi \left(\sin(2x)-3e^{-3x}\right)\,dx$

(44) $\displaystyle\int_0^1 \frac{6e^{1+\sqrt{x}}}{\sqrt{x}}\,dx$

(45) $\displaystyle\int_1^e \frac{(3+2\ln(x))^2}{4x}\,dx$

(46) $\displaystyle\int_1^e 9x^2\ln x\,dx$

(47) $\displaystyle\int_1^2 \frac{9(x^2+2)}{x^3+6x}\,dx$

(48) $\displaystyle\int_0^{\pi/2} \left(4\cos(8x)+5x^4\right)\,dx$

(49) $\displaystyle\int_0^1 \frac{6x^2}{e^{x^3-1}}\,dx$

(50) $\displaystyle\int_0^\pi (\cos(3x)-x^2)\,e^{\sin(3x)-x^3}\,dx$

(51) $\displaystyle\int_{-\pi}^{\pi/2} x\cos x\,dx$

(52) $\displaystyle\int_0^1 \frac{24(1+x)}{(1-6x-3x^2)^{2/3}}\,dx$

(53) $\displaystyle\int_1^e \frac{e^{1+\ln(x)}}{x}\,dx$

(54) $\displaystyle\int_0^{\pi/4} \cos(2x)\,(1+3\sin(2x))^{1/2}\,dx$

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

(56) $\displaystyle\int_{\pi/2}^{\pi} (\sin(3x) + 6\cos(2x))\ dx$

(57) $\displaystyle\int_{0}^{2} xe^{2x}\ dx$

(58) $\displaystyle\int_{3}^{4} \left(\frac{6}{(x-2)^3} + \frac{5}{(x-2)^2} - \frac{2}{x-2} \right) dx$

ANSWERS:

(1) $1/2$

(2) $\frac{1}{6}e^{4x^3+6x}+C$

(3) $2\sin\sqrt{x}+C$

(4) $\frac{1}{2}x^2\ln(2x-1)-\frac{1}{2}\ln(2x-1)+C$

(5) $3\sqrt{t}-\frac{3}{2}\ln|t|+\frac{1}{4}\sin 2t+C$

(6) $-\frac{2}{3x^{3/2}}+\frac{5}{x^2}-5\cos(x)+C$

(7) $2e^{\sqrt{x+1}}+C$

(8) $-\frac{1}{4}\cos\left(x^4+8x\right)+C$

(9) $\frac{1}{3}e^{t^3+3t}+C$

(10) $\sqrt{x^2+4x+9}+C$

(11) $-\frac{1}{3}\sqrt{3e^{-3x}+1}+C$

(12) $x^2\ln(3x)-\frac{1}{2}x^2+C$

(13) $\frac{4}{3}x^{3/2}-e^5x+\frac{1}{\ln 5}5^x+\sin x+C$

(14) $2\ln|x|-2\sqrt{x}+\tan x+C$

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

(16) $\ln|\ln(2x)|+C$

(17) $-\frac{4}{5}x^{5/2}+2x^{3/4}+\frac{18}{13}x^{13/6}+C$

(18) $\frac{1}{32}e^{4x}\left(24x^2-12x-5\right)+C$

(19) $\frac{1}{5}(3x+2)^2\sin 5x+\frac{6}{25}(3x+2)\cos 5x-\frac{18}{125}\sin 5x+C$

(20) $\frac{3}{4}\left(\sin^2(x)+7\right)^{2/3}+C$

(21) $-3x^2\cos x+6x\sin x+6\cos x+C$

(22) $\frac{1}{9}(\ln x+1)^3+C$

(23) $\frac{1}{3}(1+\sqrt{x})^6+C$

(24) $\frac{1}{\ln 2}x2^x-\frac{1}{(\ln 2)^2}2^x+C$

(25) $x\ln(2x)-x+C$

(26) $6\ln\left(\dfrac{e^9+2}{3}\right)$

(27) $2e^3+1$

(28) 2

(29) $6-3e^{\pi/8}$

(30) 2

(31) $2/3$

(32) $8(\pi^2-\pi-2)$

(33) $2(\ln(2))^2+e^2-1$

(34) $2\ln(8+3\ln(2))$

(35) $2\ln 2$

(36) $\dfrac{61}{4416}$

(37) $\dfrac{1}{2}\left(\ln(3)\right)^2-\dfrac{1}{2}\left(\ln(2)\right)^2$

(38) 3

(39) $\dfrac{15}{2}$

(40) $\dfrac{3}{14}$

(41) $2(e^3+3)^{3/2}-16$

(42) $\dfrac{3}{2}(e-1)$

(43) $e^{-3\pi}-1$

(44) $12(e^2-e)$

(45) $\dfrac{49}{12}$

(46) $2e^3+1$

(47) $3\ln\left(\dfrac{20}{7}\right)$

(48) $\dfrac{\pi^5}{32}$

(49) $2e-2$

(50) $\dfrac{1}{3}(e^{-\pi^3}-1)$

(51) $\frac{\pi}{2}+1$

(52) 36

(53) e^2-e

(54) $\dfrac{7}{9}$

(55) $2-5/e$

(56) $1/3$

(57) $\frac{1}{4}(3e^4+1)$

(58) $\dfrac{19}{4}-2\ln(2)$