ILATE

Math 1450, Honor Calculus Practice9, Fall 2016.

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(1) Calculate $\int \underset{A}{3x}\,\underset{L}{\ln(x^6)}\,dx$.

(2) Calculate $\int \underset{A}{x^2}\,\underset{E}{e^{-4x}}\,dx$.

(3) Calculate $\int \underset{A}{6x}\,\underset{T}{\cos(\pi x)}\,dx$.

(4) Calculate $\int 2e^x \cos(x)\,dx$.

(5) Calculate $\int 6x \arctan(x^2)dx$.

(6) Calculate $\int x^3 \sin(x^2)dx$.

(7) Calculate $\int x^3 e^{x^2} dx$.

(8) Calculate $\int \frac{xe^x}{(x+1)^2}dx$.

(1) $\int 3x \ln(x^6)dx = \int 3x \cdot 6\ln(x)dx$

$= 18\int x\ln(x)dx = 18\cdot\left[\frac{\ln(x)}{2}x^2 - \int \frac{x}{2}dx\right]$

$\boxed{\begin{array}{ll} u=\ln x & dv = x\,dx \\ du=\frac{dx}{x} & v=\frac{x^2}{2} \end{array}}$

$= 9x^2\ln(x) - 9\int x\,dx = \boxed{9x^2\ln(x) - \frac{9}{2}x^2 + C}$

(2) $\int x^2 e^{-4x}dx = -\frac{x^2}{4}e^{-4x} - \frac{x}{8}e^{-4x} - \frac{1}{32}e^{-4x} + C$

Table:

	u	dv	sign	
	x^2	e^{-4x}	+	
$\frac{d}{dx}$	$2x$	$\frac{e^{-4x}}{-4}$	−	$-\frac{x^2}{4}e^{-4x}$
$\frac{d}{dx}$	2	$\frac{e^{-4x}}{16}$	+	$-\frac{2x}{16}e^{-4x}$
$\frac{d}{dx}$	0	$\frac{e^{-4x}}{-64}$	−	$\frac{2}{-64}e^{-4x}$
			+	

(3) $\int 6x\cos(\pi x)dx$

$\boxed{\begin{array}{ll} u=6x & dv=\cos(\pi x)dx \\ du=6dx & v=\frac{\sin(\pi x)}{\pi} \end{array}}$

$= \frac{6x\cdot\sin(\pi x)}{\pi} - \frac{6}{\pi}\int\sin(\pi x)dx$

$= \frac{6x\cdot\sin(\pi x)}{\pi} - \frac{6}{\pi}\left(\frac{-\cos(\pi x)}{\pi}\right) + C$

$= \boxed{\frac{6x\sin(\pi x)}{\pi} + \frac{6}{\pi^2}\cos(\pi x) + C}$

(6) $\int x^3\sin(x^2)\,dx = -\frac{x^2\cos(x^2)}{2} + \int x\cos(x^2)dx$

$\boxed{\begin{array}{ll} u=x^2 & dv=x\sin(x^2)dx \\ du=2x\,dx & v=-\frac{\cos(x^2)}{2} \end{array}}$

$= \boxed{\frac{-x^2\cos(x^2)}{2} + \frac{\sin(x^2)}{2} + C}$

(4) $\boxed{\int \underset{E}{\underline{2e^x}}\, \underset{T}{\underline{\cos(x)dx}}} = 2e^x\cos(x) + \int 2e^x \sin(x)\,dx =$

$u = \cos(x)$ $\quad dv = 2e^x dx$

$du = -\sin(x)dx \quad v = 2e^x$

$u = \sin(x)$ $\quad dv = 2e^x dx$

$du = \cos(x)dx \quad v = 2e^x$

$= 2e^x\cos(x) + 2e^x\sin(x) - \int 2e^x\cos(x)dx$

$\Rightarrow \int 2e^x\cos(x)\,dx = 2e^x\cos(x) + 2e^x\sin(x) - \int 2e^x\cos(x)dx$

$\Rightarrow 2\int 2e^x\cos(x)dx = 2e^x\cos(x) + 2e^x\sin(x) + c_1$

$\Rightarrow \int 2e^x\cos(x)dx = e^x\cos(x) + e^x\sin(x) + c$

(5) $\int \underset{A}{\underline{6x}}\, \underset{I}{\underline{\arctan(x^2)dx}} = 3x^2\arctan(x^2) - \int \frac{6x^3}{x^4+1}dx$

$u = \arctan(x^2)$ $\quad dv = 6x\,dx$

$du = \frac{2x}{(x^2)^2+1}dx \quad v = 3x^2$

(u-sub)

$= 3x^2\arctan(x^2) - \frac{3}{2}\ln(x^4+1) + c$

(7) $\int x^3 e^{x^2}dx = \frac{x^2}{2}e^{x^2} - \int x e^{x^2}dx = \frac{x^2}{2}e^{x^2} - \frac{e^{x^2}}{2} + c$

Let $u = x^2$ $\quad dv = xe^{x^2}dx$

$du = 2x\,dx \quad v = \frac{e^{x^2}}{2}$

(8) $\int \frac{xe^x}{(x+1)^2}dx = -\frac{xe^x}{x+1} + \int \frac{e^x + xe^x}{(x+1)}dx$

$(x+1)e^x$

Let $u = xe^x$ $\quad dv = \frac{dx}{(x+1)^2}$

$du = (e^x + xe^x)dx \quad v = -\frac{1}{(x+1)}$

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

$= -\frac{xe^x}{x+1} + e^x + c$