192 Homework #1 Key

1. a. $\frac{1}{x^2}\cdot 2x = \frac{2}{x}$ (Second Fundamental Theorem of Calculus).

b. $x^4\cos(x^8)\cdot 4x^3 = 4x^7\cos(x^8)$

c. $2xe^{x^2}\int_0^x e^{-t^2}dt + e^{x^2}\cdot e^{-x^2} = 2xe^{x^2}\int_0^x e^{-t^2}dt + 1$

d. $e^{\cos(\sin^2 3t)}\cdot(-\sin(\sin^2 3t))\cdot 2\sin 3t\cos 3t\cdot 3$

e. $g(t) = \cos(\ln t)t^{-1}$ $\quad g'(t) = -\sin(\ln t)\cdot\frac{1}{t}\cdot\frac{1}{t} - \frac{1}{t^2}\cos(\ln t)$

$= -\frac{1}{t^2}\left(\sin(\ln t) + \cos(\ln t)\right)$

f. $\sec^2(\frac{1}{t})(-\frac{1}{t^2})$

g. $-\sqrt{x+\sin x}$

h. $\frac{e^x}{x} - \frac{e^{\sqrt{x}}}{\sqrt{x}}\cdot\frac{1}{2\sqrt{x}} = \frac{e^x}{x} - \frac{e^{\sqrt{x}}}{2x}$

i. $2^{t-1}\cdot\ln 2$

j. $\frac{1}{2}(x^2+3)^{-1/2}\cdot 2x = \frac{x}{\sqrt{x^2+3}}$

k. $\frac{1}{\sqrt{1-(e^t+t)^2}}\cdot(e^t+1) = \frac{e^t+1}{\sqrt{1-(e^t+t)^2}}$

2a. $\int\frac{x^2-2x}{x^3-3x^2+3x-1}$ $\qquad u = x^3-3x^2+3x-1$

$du = (3x^2-6x+3)\,dx$

$\int\frac{x^2-2x+1}{x^3-3x^2+3x-1}\;\frac{-1}{(x-1)^3}\,dx$ $\qquad 3(x^2-2x+1)$

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

$\frac{1}{3}\int\frac{du}{u} - \int\frac{1}{(x-1)^3}dx$ $\qquad (x-1)^{-3}$

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

$= \boxed{\ln|x-1| - \frac{1}{2(x-1)^2} + C}$

192 Homework #2 Key

2b. $\int \frac{1}{x\ln(x^3)}\,dx = \int \frac{1}{3x\ln x}\,dx$ $\quad u=\ln x$, $du=\frac{1}{x}dx$

$\frac{1}{3}\int \frac{1}{u}\,du = \frac{1}{3}\ln u + C = \boxed{\frac{1}{3}\ln(\ln(x)) + C}$

c. $\int \frac{1}{(x-1)\sqrt{x^2-2x}}\,dx = \int \frac{1}{(x-1)\sqrt{(x^2-2x+1)-1}}\,dx = \int \frac{1}{(x-1)\sqrt{(x-1)^2-1}}\,dx$

$u=x-1$, $du=dx$ $\quad \int \frac{1}{u\sqrt{u^2-1}}\,du = \operatorname{arcsec} u + C = \boxed{\operatorname{arcsec}(x-1)+C}$

d. $\int \frac{\sinh(x)}{1+\sinh^2 x}\,dx = \int \frac{\sinh x}{\cosh^2 x}\,dx = \int \tanh x \operatorname{sech} x\,dx =$

$\boxed{-\operatorname{sech} x + C}$

e. $\int \tan x \ln(\cos x)\,dx$ $\quad u=\ln(\cos x)$, $-du = +\tan x\,dx$

$-\int u\,du = -\frac{1}{2}u^2 + C = \boxed{-\frac{1}{2}\ln^2(\cos x)+C}$

f. $\int \frac{1}{3t+1} - \frac{17}{(4t-1)^2}\,dt$

$u=3t+1$, $du=3\,dt$, $\frac{1}{3}du=dt$ $\qquad u=4t-1$, $du=4\,dt$, $\frac{1}{4}du=dt$

$\frac{1}{3}\int \frac{1}{u}\,du \quad -\frac{17}{4}\int u^{-2}\,du$

$= \boxed{\frac{1}{3}\ln|3t+1| + \frac{17}{4}\frac{1}{4t-1} + C}$

g. $\int \frac{\sec x\tan x}{\sec x - 1}\,dx$ $\quad u=\sec x - 1$, $du = \sec x\tan x$

$\int \frac{1}{u}\,du = \ln u + C = \boxed{\ln|\sec x - 1| + C}$

h. $\int_{-2}^{2} \frac{dx}{x^2+4x+13} = \int_{-2}^{2}\frac{dx}{x^2+4x+4+9} = \int_{-2}^{2}\frac{dx}{(x+2)^2+9} = \frac{1}{3}\arctan\left(\frac{x+2}{3}\right)\Big|_{-2}^{2} =$

$\frac{1}{3}\arctan\left(\frac{4}{3}\right) - \frac{1}{3}\arctan^{0}(0) = \boxed{\frac{1}{3}\arctan(4/3)}$

192 Homework #1 Key

2i. $\int \frac{\arccos x}{\sqrt{1-x^2}}\,dx$

$u = \arccos x$

$du = -\frac{1}{\sqrt{1-x^2}}\,dx$

$\int u\,du = \frac{1}{2}u^2 + C = \boxed{\frac{1}{2}\arccos^2 x + C}$

j. $\int \frac{5}{3e^x - 2}\,dx \cdot \frac{e^{-x}}{e^{-x}} = \int \frac{5e^{-x}}{3-2e^{-x}}\,dx$

$u = 3-2e^{-x}$

$du = 2e^{-x}dx$

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

$\frac{5}{2}\int \frac{du}{u} = \frac{5}{2}\ln u + C = \boxed{\frac{5}{2}\ln|3-2e^{-x}| + C}$

k. $\int \frac{1}{(x-1)\sqrt{4x^2-8x+3}}\,dx = \int \frac{1}{(x-1)\sqrt{4x^2-8x+4-1}}\,dx = \int \frac{1}{(x-1)\sqrt{(2x-2)^2-1}}$

$u = 2x-2 \qquad x-1 = \frac{1}{2}u$

$du = 2\,dx$

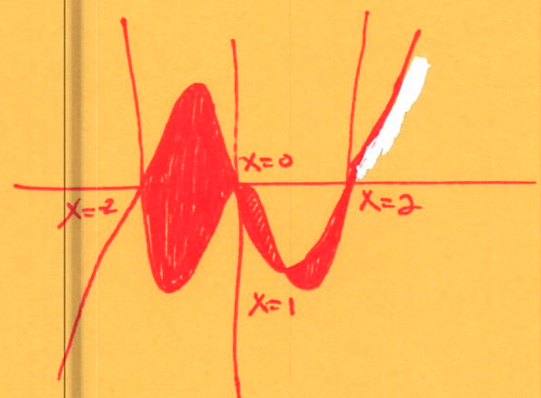
$\frac{1}{2}du = dx$

$\int \frac{\cancel{\frac{1}{2}}du}{\cancel{\frac{1}{2}}u\sqrt{u^2-1}} = \operatorname{arcsec} u + C$

$= \boxed{\operatorname{arcsec}(2x-2) + C}$

l. $\int 3^t\,dt = \boxed{\frac{1}{\ln 3}3^t + C}$

3a. $f(x) = x^4 - 4x^2 \qquad g(x) = x^3 - 4x$



$x^4 - 4x^2 = x^3 - 4x$

$x^4 - x^3 - 4x^2 + 4x = 0$

$x(x^3 - x^2 - 4x + 4) = 0$

$x[(x^2)(x-1) - 4(x-1)] = 0$

$x[(x-1)(x^2-4)] = 0$

$x=0,\ x=1,\ x=\pm 2$

$$\int_{-2}^{0} (x^3-4x)-(x^4-4x^2)\,dx + \int_0^1 (x^4-4x^2)-(x^3-4x)\,dx + \int_1^2 (x^3-4x)-(x^4-4x^2)\,dx$$

$$\int_{-2}^{0} x^3-4x-x^4+4x^2\,dx + \int_0^1 x^4-4x^2-x^3+4x\,dx + \int_1^2 x^3-4x-x^4+4x^2\,dx =$$

$$\frac{1}{4}x^4 - \frac{4}{2}x^2 - \frac{1}{5}x^5 + \frac{4}{3}x^3\Big|_{-2}^{0} + \frac{1}{5}x^5 - \frac{4}{3}x^3 - \frac{1}{4}x^4 + \frac{4}{2}x^2\Big|_0^1 + \frac{1}{4}x^4 - \frac{4}{2}x^2 - \frac{1}{5}x^5 + \frac{4}{3}x^3\Big|_1^2$$

$$\frac{124}{15} + \frac{37}{60} + \frac{53}{60} = \boxed{\frac{293}{30}}$$

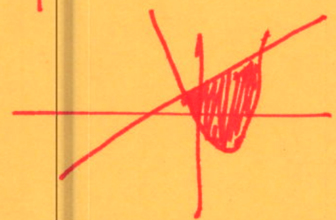
192 Homework #1 Key

3b. $y = x^2 - 2x$, $y = x+4$

$x^2 - 2x = x + 4 \Rightarrow x^2 - 3x - 4 = 0$

$(x-4)(x+1) = 0$

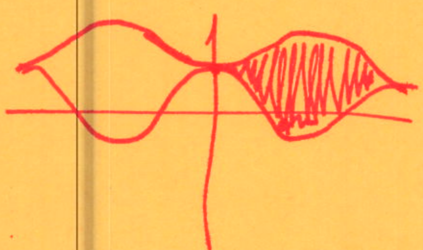
$x = -1, x = 4$



$$\int_{-1}^{4} (x+4) - (x^2-2x)\,dx = \int_{-1}^{4} 3x + 4 - x^2\,dx = \frac{3}{2}x^2 + 4x - \frac{1}{3}x^3 \Big|_{-1}^{4} = \frac{125}{6}$$

3c. $y = \cos x$, $y = 2 - \cos x$ $[0, 2\pi]$

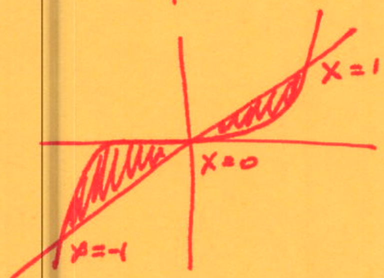
$$\int_0^{2\pi} 2 - \cos x - \cos x\,dx = \int_0^{2\pi} 2 - 2\cos x\,dx$$



$$= 2x - \overset{0}{2\sin x} \Big|_0^{2\pi} = 4\pi$$

d. $y = x^3$, $y = x$

$$\int_{-1}^{0} x^3 - x\,dx + \int_0^1 x - x^3\,dx =$$



$$\frac{1}{4}x^4 - \frac{1}{2}x^2 \Big|_{-1}^{0} + \frac{1}{2}x^2 - \frac{1}{4}x^4 \Big|_0^1 =$$

$$1/4 + 1/4 = 1/2$$

e. $y = |x|$, $y = x^2 - 2$

using symmetry

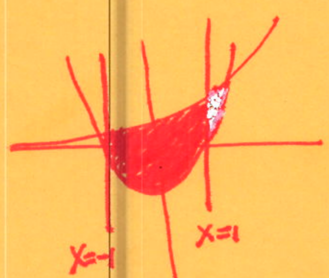
$$2\int_0^2 x - (x^2-2)\,dx = 2\int_0^2 x - x^2 + 2\,dx =$$

$$2\left(\frac{1}{2}x^2 - \frac{1}{3}x^3 + 2x\Big|_0^2 = 2(10/3) = \frac{20}{3}\right.$$

f. $y = e^x$, $y = x^2 - 1$, $x = -1, x = 1$

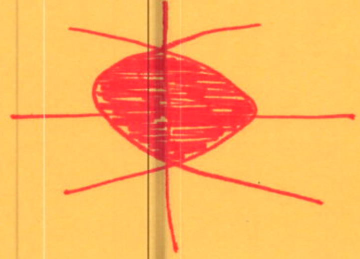
$$\int_{-1}^{1} e^x - (x^2-1)\,dx = e^x - \frac{1}{3}x^3 + x \Big|_{-1}^{1}$$

$$e - \frac{1}{e} + 4/3 \approx 3.6837$$



g. $x = 1 - y^2$, $x = y^2 - 1$

$$\int_{-1}^{1} (1-y^2) - (y^2-1)\,dy = \int_{-1}^{1} -2y^2 + 2\,dy$$



$$= -\frac{2}{3}y^3 + 2y \Big|_{-1}^{1} = 8/3$$

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3h. $x = y^4$, $y = \sqrt{2x}$, $y = 0$

$y = \sqrt[4]{x}$ $\quad y^2 = 2x$

$\left(\sqrt[4]{x} = \sqrt{2x}\right)^4 \Rightarrow x = 4x^2 \Rightarrow 4x^2 - x = 0$

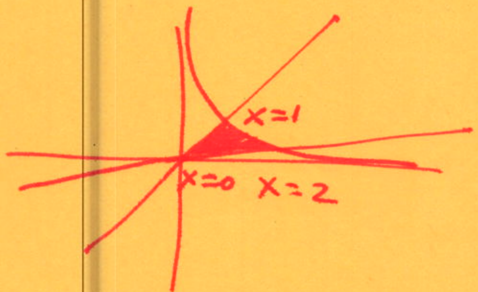
$x(4x-1) = 0$

$x = 0 \quad x = 1/4$

$\int_0^{1/4} \sqrt[4]{x} - \sqrt{2x}\, dx = \int_0^{1/4} x^{1/4} - \sqrt{2}\cdot x^{1/2}\, dx =$

$\frac{4}{5}x^{5/4} - \sqrt{2}\cdot\frac{2}{3}x^{3/2}\Big|_0^{1/4} \quad \frac{\sqrt{2}}{10} - \frac{\sqrt{2}}{12} = \frac{\sqrt{2}}{60} \approx .02357$

i. $y = 1/x$, $y = x$, $y = \frac{1}{4}x$



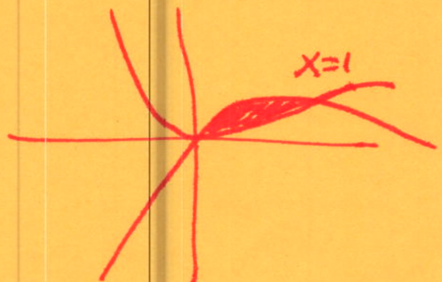
$\int_0^1 x - 1/4\,x\, dx + \int_1^2 1/x - 1/4\,x\, dx$

$\int_0^1 3/4\,x\, dx + \int_1^2 \frac{1}{x} - \frac{x}{4}\, dx =$

$\frac{3}{8}x^2\Big|_0^1 + \ln x - \frac{1}{8}x^2\Big|_1^2 =$

$\cancel{\frac{3}{8}} + \ln 2 - \cancel{3/8} = \ln 2$

j. $y = x^2e^{-x}$, $y = xe^{-x}$



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

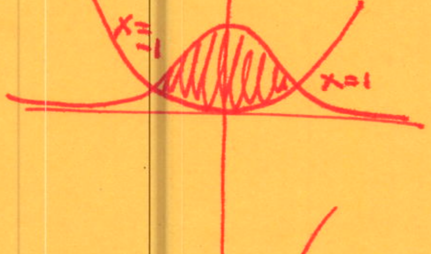
+/-	u	dv
+	$x - x^2$	e^{-x}
−	$1-2x$	$-e^{-x}$
+	-2	e^{-x}
−	0	$-e^{-x}$

$-\cancel{(x-x^2)e^{-x}}^{0} - (1-2x)e^{-x} + 2e^{-x}\Big|_0^1 =$

$-(1-2)e^{-1} + (1)e^0 + 2e^{-1} - 2e^0 =$

$\frac{1}{e} + 1 + \frac{2}{e} - 2 = \boxed{\frac{3}{e} - 1}$

4a. $y = \frac{2}{1+x^4}$, $y = x^2$



$\int_{-1}^{1} \frac{2}{1+x^4} - x^2\, dx$

b. $y = \cos x$, $y = x + 2\sin^4 x$

$\int_{-1.191}^{-1.224} (x + 2\sin^4 x) - \cos x\, dx + \int_{-1.224}^{.608} \cos x - (x + 2\sin^4 x)\, dx$

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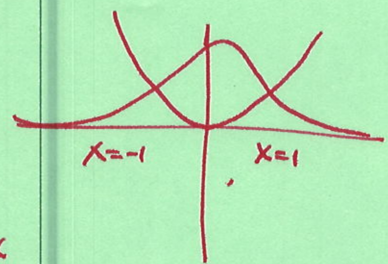
4c. $y = e^{1-x^2}$ $\quad y = x^4$

$\int_{-1}^{1} e^{1-x^2} - x^4\,dx$



5a. $\int x\cos 5x\,dx$ $\qquad u = x,\ dv = \cos 5x\,dx$
$\qquad du = dx \quad v = \frac{1}{5}\sin 5x$

$\frac{1}{5}x\sin 5x - \int \frac{1}{5}\sin 5x\,dx = \boxed{\frac{1}{5}x\sin 5x + \frac{1}{25}\cos 5x + C}$

b. $\int \ln^2 x\,dx$ $\qquad u = \ln^2 x \quad dv = dx$
$\qquad du = \frac{2\ln x}{x}dx \quad v = x$

$x\ln^2 x - \int \frac{2\ln x}{\cancel{x}}\cancel{x}\,dx$

$u = \ln x \quad dv = dx$
$du = 1/x\,dx \quad v = x$

$x\ln^2 x - 2x\ln x + 2\int \frac{1}{\cancel{x}}\cancel{x}\,dx =$

$\boxed{x\ln^2 x - 2x\ln x + 2x + C}$

c. $\int t\cosh t\,dt$ $\qquad u = t \quad dv = \cosh t\,dt$
$\qquad du = dt \quad v = \sinh t$

$t\sinh t - \int \sinh t\,dt =$

$\boxed{t\sinh t - \cosh t + C}$

d. $\int x^3 e^{-x^2}dx$ $\qquad u = x^2 \quad dv = xe^{-x^2} \longrightarrow w = -x^2 \quad dw = -2x\,dx \quad \int -\frac{1}{2}e^w dw$
$\qquad du = 2x\,dx \quad v = -\frac{1}{2}e^{-x^2}$

$-\frac{1}{2}x^2e^{-x^2} + \int xe^{-x^2}dx = \boxed{-\frac{1}{2}x^2e^{-x^2} - \frac{1}{2}e^{-x^2} + C}$

e. $\int s\,2^s ds$ $\qquad u = s \quad dv = 2^s ds$
$\qquad du = ds \quad v = \frac{2^s}{\ln 2}$

$\frac{s2^s}{\ln 2} - \int \frac{2^s}{\ln 2}ds =$

$\boxed{\frac{s2^s}{\ln 2} - \frac{1}{(\ln 2)^2}2^s + C}$

f. $\int \arctan 4t\,dt$ $\qquad u = \arctan 4t \quad dv = dt$
$\qquad du = \frac{1}{1+16t^2}\cdot 4 \quad v = t$

$t\arctan 4t - \int \frac{4t}{1+16t^2}dt$

$u = 1+16t^2$
$du = 32t\,dt$

$\boxed{t\arctan 4t - \frac{1}{8}\ln|1+16t^2| + C}$

g. $\int (x^2+1)e^{-x}dx$ $\qquad u = (x^2+1) \quad dv = e^{-x}$
$\qquad du = 2x \quad v = -e^{-x}$

$\qquad u = 2x \quad dv = e^{-x}$
$\qquad du = 2dx \quad v = -e^{-x}$

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

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

$\boxed{-(x^2+1)e^{-x} - 2xe^{-x} - 2e^{-x} + C}$

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5h. $\int_0^1 \frac{r^3}{\sqrt{4+r^2}}\,dr$

$u = r^2$, $du = 2r$

$dv = \frac{r}{\sqrt{4+r^2}}$

$w = 4+r^2$, $dw = 2r\,dr$, $v = \int \frac{1}{2} w^{-1/2}\,dw$

$\frac{\frac{1}{2}}{\frac{1}{2}} w^{1/2}$

$v = \sqrt{4+r^2}$

$r^2\sqrt{4+r^2} - \int 2r\sqrt{4+r^2}\,dr$

$w = 4+r^2$, $dw = 2r\,dr$, $\int w^{1/2}\,dw$

$$\boxed{r^2\sqrt{4+r^2} - \frac{2}{3}(4+r^2)^{3/2} + C}$$

$r^2\sqrt{4+r^2} - \frac{2}{3}(4+r)^{3/2}\Big|_0^1 =$

$(1)\sqrt{5} - \frac{2}{3}(5)^{3/2} - 0 + \frac{2}{3}(4)^{3/2} =$

$\sqrt{5} - \frac{10}{3}\sqrt{5} + \frac{2}{3}(8) = \sqrt{5}(-7/3) + \frac{16}{3} =$

$\frac{16 - 7\sqrt{5}}{3}$

i. $\int_0^\pi e^{\cos t}\sin 2t\,dt$

$2\int_0^\pi e^{\cos t}\sin t\cos t\,dt \Rightarrow$ $w = \cos t$, $dw = -\sin t$

$-2\int_1^{-1} e^w w\,dw = 2\int_{-1}^1 w e^w\,dw$

$u = w$, $du = dw$; $dv = e^w$, $v = e^w$

$2\left(we^w - e^w\Big|_{-1}^{+1} = 2\left(e - e - (-1e^{-1} - e^{-1})\right)\right) = 2\left(0 + \frac{1}{e} + \frac{1}{e}\right) = 2\left(\frac{2}{e}\right) = \frac{4}{e}$

6. $\int x^n \ln x\,dx$

$u = \ln x$, $du = \frac{1}{x}$

$dv = x^n\,dx$, $v = \frac{1}{(n+1)}x^{n+1}$

$\frac{1}{(n+1)}x^{n+1}\ln x - \int \frac{1}{(n+1)} x^{n+1} \cdot \frac{1}{x}\,dx$

$= \frac{1}{(n+1)}x^{n+1}\ln x - \frac{1}{n+1}\int x^n\,dx = \boxed{\frac{1}{(n+1)}x^{n+1}\ln x - \frac{1}{(n+1)^2}x^{n+1} + C}$

7.

a.

+/-	u	dv
+	z^3	e^z
−	$3z^2$	e^z
+	$6z$	e^z
−	6	e^z
+	0	e^z

$\int z^3 e^z\,dz = z^3e^z - 3z^2e^z + 6ze^z - 6e^z + C$

b.

+/-	u	dv
+	t^4	$\sinh t$
−	$4t^3$	$\cosh t$
+	$12t^2$	$\sinh t$
−	$24t$	$\cosh t$
+	24	$\sinh t$
−	0	$\cosh t$

$\int t^4 \sinh t\,dt =$

$t^4\cosh t - 4t^3\sinh t +$

$12t^2\cosh t - 24t\sinh t +$

$24\cosh t + C$

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7c.

+/−	u	dv
+	p^5	$\cos p$
−	$5p^4$	$\sin p$
+	$20p^3$	$-\cos p$
−	$60p^2$	$-\sin p$
+	$120p$	$\cos p$
−	120	$\sin p$
+	0	$-\cos p$

$$\int p^5 \cos p \, dp = p^5 \sin p + 5p^4 \cos p - 20p^3 \sin p - 60p^2 \cos p + 120p \sin p + 120 \cos p + C$$

8a. $\int e^{2\theta} \sin 3\theta \, d\theta$

$u = \sin 3\theta \quad dv = e^{2\theta} d\theta$

$du = 3\cos 3\theta \quad v = \frac{1}{2}e^{2\theta}$

$\frac{1}{2}\sin 3\theta \cdot e^{2\theta} - \frac{3}{2}\int \cos 3\theta \cdot e^{2\theta} \cdot d\theta$

$u = \cos 3\theta \quad dv = e^{2\theta} d\theta$

$du = -3\sin 3\theta \, d\theta \quad v = \frac{1}{2}e^{2\theta}$

$\frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{2}\left[\frac{1}{2}\cos 3\theta \cdot e^{2\theta} + \int + \frac{3}{2}\sin 3\theta \, e^{2\theta} d\theta\right]$

$\frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{4}e^{2\theta}\cos 3\theta - \frac{9}{4}\int e^{2\theta}\sin 3\theta \, d\theta = \int e^{2\theta}\sin 3\theta \, d\theta$

$+\frac{9}{4}\int e^{2\theta}\sin 3\theta \, d\theta = \frac{9}{4}\int e^{2\theta}\sin 3\theta \, d\theta$

$\frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{4}e^{2\theta}\cos 3\theta = \frac{13}{4}\int e^{2\theta}\sin 3\theta \, d\theta$

$\frac{4}{13}\left[\frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{4}e^{2\theta}\cos 3\theta\right] + C = \int e^{2\theta}\sin 3\theta \, d\theta$

$= \boxed{\frac{2}{13}e^{2\theta}\sin 3\theta - \frac{3}{13}e^{2\theta}\cos 3\theta + C}$

b. $\int \sec^3\theta \, d\theta$

$u = \sec\theta \quad dv = \sec^2\theta$

$du = \sec\theta\tan\theta \quad v = \tan\theta$

$\sec\theta\tan\theta - \int \sec\theta\tan^2\theta \, d\theta = \sec\theta\tan\theta - \int \sec\theta(\sec^2\theta - 1)\, d\theta =$

$\sec\theta\tan\theta - \int \sec^3\theta \, d\theta + \int \sec\theta \, d\theta = \int \sec^3\theta \, d\theta$

$+\int \sec^3\theta \, d\theta \qquad \int \sec^3\theta \, d\theta$

$\sec\theta\tan\theta + \ln|\sec\theta + \tan\theta| = 2\int \sec^3\theta \, d\theta$

8b cont'd

$$\int \sec^3\theta \, d\theta = \boxed{\frac{1}{2}\sec\theta\tan\theta + \frac{1}{2}\ln|\sec\theta+\tan\theta| + C}$$

9. $\int e^{2\theta}\sin 3\theta \, d\theta = \int e^{2\theta}\left(\frac{e^{3i\theta}-e^{-3i\theta}}{2i}\right)d\theta =$

$\frac{1}{2i}\int e^{(2+3i)\theta} - e^{(2-3i)\theta}\,d\theta = \frac{1}{2i}\left[\frac{e^{(2+3i)\theta}}{2+3i} - \frac{e^{(2-3i)\theta}}{2-3i}\right]+C =$

$\frac{1}{2i}\left[\frac{e^{(2+3i)\theta}(2-3i)}{(2+3i)(2-3i)} - \frac{e^{(2-3i)\theta}(2+3i)}{(2-3i)(2+3i)}\right]+C =$

$\frac{1}{2i}\left[\frac{2e^{(2+3i)\theta} - 3ie^{(2+3i\theta)} - 2e^{(2-3i)\theta} - 3ie^{(2-3i)\theta}}{4+9}\right]+C =$

$\cancel{\frac{1}{2i}} \cdot \frac{1}{13}e^{2\theta}\left[\frac{2e^{3i\theta}-2e^{-3i\theta} - 3ie^{3i\theta} - 3ie^{-3i\theta}}{2i}\right]+C =$

$\frac{1}{13}e^{2\theta}\left[2(\underbrace{\sin 3\theta}_{\frac{e^{3i\theta}-e^{-3i\theta}}{2}}) - 3(\underbrace{\cos 3\theta}_{\frac{-3\cancel{i}(e^{3i\theta}+e^{-3i\theta})}{2\cancel{i}}})\right]+C =$

$$\boxed{\frac{2}{13}e^{2\theta}\sin 3\theta - \frac{3}{13}e^{2\theta}\cos 3\theta + C}$$

matches 8a.