DAY 111 CH 7 p. 360 #23-42

(23) $\int \sin\theta(\cos\theta+5)^7 d\theta$

$u=\cos\theta+5$
$du=-\sin\theta d\theta$
$-du=\sin\theta d\theta$

$-\int u^7 du$
$=-\frac{1}{8}u^8+C \rightarrow \boxed{-\frac{1}{8}(\cos\theta+5)^8+C}$

(24) $\int \sqrt{\cos 3t}\sin 3t\,dt$

$u=\cos 3t$
$du=-3\sin 3t\,dt$
$-\frac{1}{3}du=\sin 3t\,dt$

$\frac{1}{3}\int \sqrt{u}\,du$
$=\frac{2}{9}u^{3/2}+C \rightarrow \boxed{\frac{2}{9}(\cos 3t)^{3/2}+C}$

(25) $\int \sin^6\theta\cos\theta\,d\theta$

$u=\sin\theta$
$du=\cos\theta\,d\theta$

$\int u^6 du$
$\frac{1}{7}u^7+C \rightarrow \frac{1}{7}(\sin\theta)^7+C$
$=\boxed{\frac{1}{7}\sin^7\theta+C}$

(26) $\int \sin^3 x\cos x\,dx$

$u=\sin x$
$du=\cos x\,dx$

$\int u^3 du$
$\frac{1}{4}u^4+C \rightarrow \boxed{\frac{1}{4}\sin^4 x+C}$

(27) $\int \sin^6(5\theta)\cos(5\theta)\,d\theta$

$u=\sin 5\theta$
$du=5\cos 5\theta\,d\theta$
$\frac{1}{5}du=\cos 5\theta\,d\theta$

$\frac{1}{5}\int u^6 du$
$\frac{1}{35}u^7+C \rightarrow \boxed{\frac{1}{35}\sin^7(5\theta)+C}$

(28) $\int \tan(2x)\,dx$

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

$\frac{1}{2}\int \tan u\,du$
$\frac{1}{2}\int \frac{\sin u}{\cos u}du \rightarrow -\int \frac{1}{u}du$
$=\boxed{-\ln|u|+C}$
$=-\frac{1}{2}\ln|\cos u|+C$
$=\frac{1}{2}\ln|\sec u|+C$
$=\boxed{\frac{1}{2}\ln|\sec(2x)|+C}$

$w=\cos u$
$dw=-\sin u\,du$
$-dw=\sin u\,du$

u-sub twice

or remember $\boxed{\int \tan x\,dx = \ln|\sec x|+C}$

(29) $\int \frac{(\ln z)^2}{z}dz$

$u=\ln z$
$du=\frac{1}{z}dz$

$\int u^2 du$
$=\frac{1}{3}u^3+C \rightarrow \boxed{\frac{1}{3}(\ln z)^3+C}$

(30) $\int \frac{e^t+1}{e^t+t}dt$

$u=e^t+t$
$du=(e^t+1)dt$

$\int \frac{1}{u}du$
$=\ln|u|+C \rightarrow \boxed{\ln|e^t+t|+C}$

(31) $\int \frac{(t+1)^2}{t^2}dt = \int \frac{t^2+2t+1}{t^2}dt = \int\left(1+\frac{2}{t}+t^{-2}\right)dt$

not u-sub

$=\boxed{t+2\ln|t|-\frac{1}{t}+C}$

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(32) $\int \frac{y}{y^2+4}\,dy$

$u = y^2+4$
$du = 2y\,dy$
$\frac{1}{2}du = y\,dy$

$\frac{1}{2}\int \frac{du}{u}$
$= \frac{1}{2}\ln|u| + C \rightarrow \boxed{\frac{1}{2}\ln|y^2+1| + C}$

(33) $\int \frac{dx}{1+2x^2} = \int \frac{dx}{1+(\sqrt{2}x)^2}$

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

$\frac{1}{\sqrt{2}}\int \frac{du}{1+u^2}$
$\frac{1}{\sqrt{2}}\arctan(u) + C \rightarrow \boxed{\frac{1}{\sqrt{2}}\arctan(\sqrt{2}x) + C}$

(34) $\int \frac{dx}{\sqrt{1-4x^2}} = \int \frac{dx}{\sqrt{1-(2x)^2}} =$

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

$\frac{1}{2}\int \frac{du}{\sqrt{1-u^2}}$
$\frac{1}{2}\arcsin(u) + C \rightarrow \boxed{\frac{1}{2}\arcsin(2x) + C}$

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

$u = \sqrt{x}$
$du = \frac{1}{2\sqrt{x}}dx$
$2du = \frac{dx}{\sqrt{x}}$

$2\int \cos u\,du$
$2\sin u + C \rightarrow \boxed{2\sin\sqrt{x} + C}$

(36) $\int \frac{e^{\sqrt{y}}}{\sqrt{y}}\,dy$

$u = \sqrt{y}$
$du = \frac{1}{2\sqrt{y}}dy$
$2\,du = \frac{dy}{\sqrt{y}}$

$2\int e^u\,du$
$2e^u + C \rightarrow \boxed{2e^{\sqrt{y}} + C}$

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

$u = x+e^x$
$du = (1+e^x)dx$

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

(38) $\int \frac{e^x}{2+e^x}\,dx$

$u = 2+e^x$
$du = e^x\,dx$

$\int \frac{1}{u}\,du$
$\ln|u| + C \rightarrow \boxed{\ln|2+e^x| + C}$

(39) $\int \frac{x+1}{x^2+2x+19}\,dx$

$u = x^2+2x+19$
$du = 2x+2\,dx$
$\frac{1}{2}du = (x+1)dx$

$\frac{1}{2}\int \frac{1}{u}du$
$\frac{1}{2}\ln|u| + C \rightarrow \boxed{\frac{1}{2}\ln|x^2+2x+19| + C}$

(40) $\int \frac{t}{1+3t^2}\,dt$

$u = 1+3t^2$
$du = 6t\,dt$
$\frac{1}{6}du = t\,dt$

$\frac{1}{6}\int \frac{1}{u}du$
$\frac{1}{6}\ln|u| + C \rightarrow \boxed{\frac{1}{6}\ln|1+3t^2| + C}$

(41) $\int \frac{e^x - e^{-x}}{e^x+e^{-x}}\,dx$

$u = e^x - e^{-x}$
$du = (e^x+e^{-x})dx$

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

(42) $\int \frac{x\cos(x^2)}{\sqrt{\sin x^2}}\,dx$

$u = \sin x^2$
$du = \cos x^2\,(2x)\,dx$
$\frac{1}{2}du = x\cos x^2\,dx$

$\frac{1}{2}\int \frac{1}{\sqrt{u}}du = \frac{1}{2}\int u^{-\frac{1}{2}}du$
$= \sqrt{u} + C \rightarrow \boxed{\sqrt{\sin x^2} + C}$