Integration by Substitution

ex) $\int 42x(x^2+4)^{20}\,dx \rightarrow \int 42\left(\tfrac{1}{2}\right)u^{20}\,du$

let $u = x^2+4$

now $\dfrac{du}{dx} = 2x$

$\dfrac{1\,du}{2} = \dfrac{\cancel{2}x\,dx}{\cancel{2}}$

$\int 21u^{20}\,du$

$u^{21}+C$

$\boxed{(x^2+4)^{21}+C}$

ex) $\int 3x^2\sqrt{5+x^3}\,dx \longrightarrow \int u^{1/2}\,du$

let $u = 5+x^3$

$\frac{du}{dx} = 3x^2$

$du = 3x^2\,dx$

$\frac{2}{3}u^{3/2} + C$

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

ex) $\int_0^{\pi/8} \tan(2x)\sec^2(2x)\,dx \rightarrow \int_0^1 \frac{1}{2}u\,du$

let $u = \tan(2x)$ $\quad = \frac{1}{4}u^2 \Big|_0^1$

$\frac{1}{2}du = \cancel{\frac{2}{2}}\sec^2(2x)\,dx$

$= \frac{1}{4}$

ex) $\int_0^1 \frac{2x+8}{x^2+8x+1}\,dx \rightarrow \int_1^{10} \frac{1}{u}\,du$

let $u = x^2+8x+1$ $\quad = \ln u \Big|_1^{10}$

$du = 2x+8\,dx$

$= \ln 10$

ex) $\int \frac{x}{(x^2+1)^3}\,dx \rightarrow \int \frac{1/2}{u^3}\,du$

let $u = x^2+1$

$\frac{1}{2}du = \cancel{\frac{2}{2}}x\,dx$ $\quad \int \frac{1}{2}u^{-3}\,du$

$-\frac{1}{4}u^{-2} + C$

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

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

Try pg. 321-322
#1-8 warm up (easy)
#9-11, 13, 19, 22, 25 (ind.)
#33, 34, 37 (def.)