

27) $\int \sqrt{\tan x} \sec^2 x \, dx$

$u = \tan x$
 $du = \sec^2 x \, dx$

$$= \int \sqrt{u} \, du$$

$$= \int u^{1/2} \, du$$

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

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

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

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

$$\int u^6 \, du$$

$$\frac{u^7}{7} + C$$

$$\frac{\ln^7 x}{7} + C$$

6.2.2 More U-Substitution

(do if you didn't in 6.2.1)

$$\int \underline{e^x} \tan e^x \underline{dx}$$

$$u = e^x \\ du = e^x dx \quad \int \tan u \, du$$

$$\int \frac{\sin u}{\cos u} \, du$$

$$w = \cos u \\ dw = -\sin u \, du \\ -dw = \sin u \, du \quad -\int \frac{1}{w} \, dw$$

$$= -[\ln|w| + c]$$

$$= -\ln|w| + c$$

$$= -\ln|\cos u| + c$$

$$= -\ln|\cos e^x| + c$$

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U-Substitution with definite integrals

$$1. \int_1^2 \frac{2x}{(x^2+3)^2} dx$$

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

$$= \int u^{-2} \, du$$

$$= -u^{-1}$$

$$= -\frac{1}{u}$$

$$= -\left[\frac{1}{x^2+3} \right]_1^2$$

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

$$= -\left[\frac{1}{7} - \frac{1}{4} \right] = -\left(-\frac{3}{28} \right)$$

$$= \left(\frac{3}{28} \right)$$

$$2. \int_e^{e^4} \frac{2}{x \ln x} dx$$

$$u(e^4) = \ln e^4 = 4 \\ u(e) = \ln e = 1$$

$$2 \int_e^{e^4} \frac{1}{x \ln x} dx$$

$$u = \ln x \\ du = \frac{1}{x} dx \quad 2 \int_1^4 \frac{1}{u} \, du$$

$$2 [\ln|u|]_1^4$$

$$2 [\ln 4 - \ln 1]$$

$$2 \ln 4$$

or

$$\ln 16$$

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$$3. 4 \int_0^{\pi} \sin x \cos^2 x dx$$

$$u = \cos x$$

$$du = -\sin x dx \quad -4 \int_{-1}^1 u^2 du$$

$$-du = \sin x dx$$

$$u(\pi) = \cos \pi = -1 \quad 4 \int_{-1}^1 u^2 du$$

$$u(0) = \cos 0 = 1$$

$$4 \left[\frac{u^3}{3} \right]_{-1}^1$$

$$4 \left[\frac{1}{3} - \left(-\frac{1}{3} \right) \right]$$

$$4 \left[\frac{2}{3} \right] = \left(\frac{8}{3} \right)$$

$$4. \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} -\cot x \csc^2 x dx$$

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$$5. \int_0^6 \frac{20}{x^2 + 36} dx$$

$$6. \int_0^1 r \sqrt{1-r^2} dr$$

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$$7. \int_{-1}^1 \frac{x}{(4+x^2)^2} dx$$

$$u(1) = 4 + 1^2 = 5$$

$$u(-1) = 4 + (-1)^2 = 5$$

$$u = 4 + x^2$$

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

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

$$\frac{1}{2} \int_5^5 \frac{1}{u^2} du$$

$$= 0$$

$$8. \int_2^5 \frac{dx}{2x-3}$$

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$$9. \int \frac{\sin \sqrt{x}}{\sqrt{x}} dx$$

$$10. \int_0^{13} \frac{1}{\sqrt[3]{(1+2x)^2}} dx$$

$$u = \sqrt{x}$$

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

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

$$2 \int \sin u du$$

$$= 2(-\cos u + C)$$

$$= -2 \cos u + C$$

$$= -2 \cos \sqrt{x} + C$$

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11.
$$\int_0^{\frac{\pi}{2}} \cos x \sin(\sin x) dx$$

12.
$$\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} \tan^3 x dx$$

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