6.2.1

$f'(x) = 2x \cdot \sin(x^2)$

2x is the deriv. of inside fnc.

$f(x) = -\cos(x^2) + C$

$\int 2x \sin(x^2)\,dx$

$u = x^2$

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

$du = 2x\,dx$

$\int \sin u\,du$

$-\cos u + C$

$-\cos(x^2) + C$

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1. $\int e^{\cos x} \sin x\,dx$

$u = \cos x$

$\frac{du}{dx} = -\sin x$

$du = -\sin x\,dx$

$-du = \sin x\,dx$

$\int e^u (-du)$

$-\int e^u du$

$-e^u + C$

$-e^{\cos x} + C$

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$$2.\ \int \sin^3 x \cos x\,dx$$

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

$u = \sin x$

$du = \cos x\,dx$

$$= \int u^3\,du$$

$$= \frac{1}{4}u^4 + C$$

$$= \frac{1}{4}\sin^4 x + C$$

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$$3.\ \int x e^{x^2} dx$$

$u = x^2$

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

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

$$\int e^u \left(\frac{1}{2}du\right)$$

$$\frac{1}{2}\int e^u du$$

$$\frac{1}{2}\left(e^u + C\right)$$

$$\frac{1}{2}e^{x^2} + C$$

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$$\int x^3 \cos(3x^4)\,dx$$

$u = 3x^4$

$\frac{du}{dx} = 12x^3$

$\frac{1}{12}\,du = x^3\,dx$

$\frac{1}{12}\int \cos(u)\,du$

$\frac{1}{12}\sin u + C$

$\frac{1}{12}\sin(3x^4) + C$

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5. $\int \sqrt{\sec x}\cdot \sec x \tan x\,dx$

$u = \sec x$

$du = \sec x \tan x\,dx$

$\int u^{\frac{1}{2}}\,du$

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

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

$\frac{2}{3}\sec^{\frac{3}{2}} x + C$

$\frac{2}{3}\sqrt{\sec^3 x} + C$

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6. $\int \frac{\ln^4 x}{2x}\,dx$

$\frac{1}{2}\int \frac{(\ln x)^4}{x}\,dx$

$u = \ln x$

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

$\frac{1}{2}\int u^4\,du$

$\frac{1}{2}\left(\frac{1}{5}u^5\right) + C$

$\frac{1}{10}\ln^5 x + C$

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7. $\int \frac{3\csc^2\theta}{\cot\theta}\,d\theta$

$3\int \frac{(\csc\theta)^2}{\cot\theta}\,d\theta$

$u = \cot\theta$

$du = -\csc^2\theta\,d\theta$

$-du = \csc^2\theta\,d\theta$

$3\int \frac{-du}{u}$

$-3\int \frac{du}{u} = -3\int \frac{1}{u}\,du$

$-3\ln|u| + C$

$-3\ln|\cot\theta| + C$

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8. $\int \tan x\,dx$

$\int \frac{\sin x}{\cos x}\,dx$

$u = \cos x$

$du = -\sin x\,dx$

$-du = \sin x\,dx$

$\int -\frac{du}{u}$

$-\int \frac{du}{u} = -\ln|u| + C$

$= -\ln|\cos x| + C$

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9. $\int \frac{\sqrt{\ln x}}{4x}\,dx$

$\frac{1}{4}\int \frac{\sqrt{\ln x}}{x}\,dx$

$u = \ln x$

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

$\frac{1}{4}\int \sqrt{u}\,du$

$\frac{1}{4}\int u^{\frac{1}{2}}\,du$

$\frac{1}{4}\left(\frac{2}{3}u^{\frac{3}{2}}\right) + C$

$\frac{1}{6}(\ln x)^{\frac{3}{2}} + C$

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10. $\int \frac{dx}{x^2+16}$

$\int \frac{dx}{16\left(\frac{x^2}{16}+1\right)}$

$\frac{1}{16}\int \frac{dx}{\left(\frac{x}{4}\right)^2+1}$

$u = \frac{x}{4}$

$du = \frac{1}{4}dx$

$4du = dx$

$\frac{1}{16}\int \frac{4du}{u^2+1}$

$\frac{1}{4}\int \frac{du}{u^2+1} = \frac{1}{4}\tan^{-1}u + C$

$= \frac{1}{4}\tan^{-1}\frac{x}{4} + C$

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11. $\int \frac{x}{x^2+1}\,dx$

$u = x^2+1$

$du = 2x\,dx$

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

$\int \frac{\frac{1}{2}du}{u}$

$\frac{1}{2}\int \frac{du}{u}$

$\frac{1}{2}\ln|u| + C$

$\frac{1}{2}\ln|x^2+1| + C$

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