

$$1. \int \cos(2x) dx$$

$$\begin{aligned} u &= 2x & \int \cos u \cdot \frac{du}{2} \\ \frac{du}{dx} &= 2 & \frac{1}{2} \int \cos u \, du \\ dx &= \frac{du}{2} & \frac{1}{2} \sin u + C \\ & & \frac{1}{2} \sin 2x + C \end{aligned}$$

$$5. \int 3 \sqrt[4]{2x+1} \, dx$$

$$\begin{aligned} u &= 2x+1 & \int 3 u^{1/4} \cdot \frac{du}{2} \\ \frac{du}{dx} &= 2 & \frac{3}{2} \int u^{1/4} \, du \\ dx &= \frac{du}{2} & \frac{12}{10} u^{5/4} + C \\ & & \frac{6}{5} (2x+1)^{5/4} + C \end{aligned}$$

$$2. \int \frac{2x^3 + 7x^{2/3}}{2x \sqrt[3]{x}} \, dx$$

$$\begin{aligned} & \frac{1}{2} \int (2x^3 + 7x^{2/3}) x^{-4/3} \, dx \\ & \frac{1}{2} \int 2x^{5/3} + 7x^{-2/3} \, dx \\ & \frac{1}{2} \left[ \frac{6}{8} x^{8/3} + 21 x^{1/3} \right] + C \\ & \frac{3}{8} x^{8/3} + \frac{21}{2} x^{1/3} + C \end{aligned}$$

$$6. \int \sin(3x) \cos^4(3x) \, dx$$

$$\begin{aligned} u &= \cos(3x) & \int \sin(3x) \cdot u^4 \cdot \frac{du}{-3 \sin(3x)} \\ \frac{du}{dx} &= -\sin(3x) \cdot 3 & -\frac{1}{3} \int u^4 \, du \\ dx &= \frac{du}{-3 \sin(3x)} & -\frac{1}{15} u^5 + C \\ & & -\frac{1}{15} (2x+1)^5 + C \end{aligned}$$

$$3. \int -5x(x^2+5)^4 \, dx$$

$$\begin{aligned} u &= x^2+5 & \int -5x \cdot u^4 \cdot \frac{du}{2x} \\ \frac{du}{dx} &= 2x & -\frac{5}{2} \int u^4 \, du \\ dx &= \frac{du}{2x} & -\frac{1}{2} u^5 + C \\ & & -\frac{1}{2} (x^2+5)^5 + C \end{aligned}$$

$$7. \int \left( \frac{\csc^2(2x)}{5} + 3 \right) \, dx$$

$$\begin{aligned} & \int \frac{\csc^2(2x)}{5} \, dx + \int 3 \, dx \\ u &= 2x & \int \frac{\csc^2 u}{5} \cdot \frac{du}{2} \\ \frac{du}{dx} &= 2 & \frac{1}{10} \int \csc^2 u \, du \\ dx &= \frac{du}{2} & -\frac{1}{10} \cot u \\ & & -\frac{1}{10} \cot(2x) + 3x + C \end{aligned}$$

$$4. \int \frac{6}{\sqrt{3x-5}} \, dx$$

$$\begin{aligned} u &= 3x-5 & \int \frac{6}{\sqrt{u}} \cdot \frac{du}{3} \\ \frac{du}{dx} &= 3 & 2 \int u^{-1/2} \, du \\ dx &= \frac{du}{3} & 4 u^{1/2} + C \\ & & 4(3x-5)^{1/2} + C \end{aligned}$$

$$8. \int (-5e^{2x} + 2^{3x-1}) \, dx$$

$$\begin{aligned} & \int -5e^{2x} \, dx + \int 2^{3x-1} \, dx \\ u &= 2x & \int -5e^u \cdot \frac{du}{2} & u=3x-1 & \int 2^u \cdot \frac{du}{3} \\ \frac{du}{dx} &= 2 & -\frac{5}{2} \int e^u \, du & \frac{du}{dx} &= 3 & \frac{1}{3} \int 2^u \, du \\ dx &= \frac{du}{2} & -\frac{5}{2} e^u & dx &= \frac{du}{3} & \frac{1}{3} \cdot \frac{2^u}{\ln 2} \\ & & -\frac{5}{2} e^{2x} & & \frac{1}{3} \cdot \frac{2^{3x-1}}{\ln 2} \\ & & -\frac{5}{2} e^{2x} + \frac{2^{3x-1}}{3 \ln 2} + C \end{aligned}$$

$$9. \int \frac{3x}{2x^2-6} dx$$

$$\begin{aligned} u &= 2x^2-6 & \int \frac{3x}{u} \cdot \frac{du}{4x} \\ \frac{du}{dx} &= 4x & \frac{3}{4} \int \frac{1}{u} du \\ dx &= \frac{du}{4x} & \frac{3}{4} \ln|u| + C \\ & & \frac{3}{4} \ln|2x^2-6| + C \end{aligned}$$

$$13. \int \frac{\sin x}{\cos^2 x} \sqrt{\sec x} dx$$

$$\begin{aligned} u &= \sec x & \int \frac{\cancel{\sin x}}{\cancel{\cos^2 x}} \cdot u^{1/2} \cdot \frac{du}{\sec x \tan x} \\ \frac{du}{dx} &= \sec x \tan x & \int u^{1/2} du \\ dx &= \frac{du}{\sec x \tan x} & \frac{2}{3} u^{3/2} + C \\ & & \frac{2}{3} (\sec x)^{3/2} + C \end{aligned}$$

$$10. \int 5^{\cos x+2} \sin x dx$$

$$\begin{aligned} u &= \cos x + 2 & \int 5^u \cdot \sin x \cdot \frac{du}{-\sin x} \\ \frac{du}{dx} &= -\sin x & - \int 5^u du \\ dx &= \frac{du}{-\sin x} & - \frac{5^u}{\ln 5} + C \\ & & - \frac{5^{\cos x+2}}{\ln 5} + C \end{aligned}$$

$$14. \int \frac{3x^2-5}{\sqrt{2x^3-10x}} dx$$

$$\begin{aligned} u &= 2x^3-10x & \int \frac{3x^2-5}{u^{1/2}} \cdot \frac{du}{2(3x^2-5)} \\ \frac{du}{dx} &= 6x^2-10 & \frac{1}{2} \int u^{-1/2} du \\ dx &= \frac{du}{2(3x^2-5)} & u^{1/2} + C \\ & & (2x^3-10x)^{1/2} + C \end{aligned}$$

$$11. \int \frac{-4x}{9-16x^2} dx$$

$$\begin{aligned} u &= 9-16x^2 & \int \frac{-4x}{u} \cdot \frac{du}{-32x} \\ \frac{du}{dx} &= -32x & \frac{1}{8} \int \frac{1}{u} du \\ dx &= \frac{du}{-32x} & \frac{1}{8} \ln|u| + C \\ & & \frac{1}{8} \ln|9-16x^2| + C \end{aligned}$$

$$15. \int \frac{x}{3x^2-5} dx$$

$$\begin{aligned} u &= 3x^2-5 & \int \frac{x}{u} \cdot \frac{du}{6x} \\ \frac{du}{dx} &= 6x & \frac{1}{6} \int \frac{1}{u} du \\ dx &= \frac{du}{6x} & \frac{1}{6} \ln|u| + C \\ & & \frac{1}{6} \ln|3x^2-5| + C \end{aligned}$$

$$12. \int \sec(3x) dx$$

$$\begin{aligned} u &= 3x & \int \sec u \cdot \frac{du}{3} \\ \frac{du}{dx} &= 3 & \frac{1}{3} \int \sec u du \\ dx &= \frac{du}{3} & \frac{1}{3} \ln|\sec u + \tan u| + C \\ & & \frac{1}{3} \ln|\sec 3x + \tan 3x| + C \end{aligned}$$

$$16. \int \frac{\cancel{\csc(3x)} \cot(3x)}{\cancel{\csc(3x)}} dx$$

$$\int \cot(3x) dx$$

$$u = 3x \quad \int \cot u \cdot \frac{du}{3}$$

$$\frac{du}{dx} = 3 \quad \frac{1}{3} \int \cot u du$$

$$dx = \frac{du}{3} \quad \frac{1}{3} \ln |\sin u| + C$$

$$\frac{1}{3} \ln |\sin 3x| + C$$

$$17. \int \frac{-x e^{3x^2}}{e^{3x^2} + 5} dx$$

$$u = e^{3x^2} + 5 \quad \int \frac{-x e^{3x^2}}{u} \cdot \frac{du}{e^{3x^2} \cdot 6x}$$

$$\frac{du}{dx} = e^{3x^2} \cdot 6x \quad -\frac{1}{6} \int \frac{1}{u} du$$

$$dx = \frac{du}{e^{3x^2} \cdot 6x} \quad -\frac{1}{6} \ln |u| + C$$

$$-\frac{1}{6} \ln |e^{3x^2} + 5| + C$$

$$18. \int \frac{-2 - 4 \sin(8x)}{4x - \cos(8x)} dx$$

$$u = 4x - \cos(8x)$$

$$\frac{du}{dx} = 4 + \sin(8x)(8)$$

$$dx = \frac{du}{4 + 8 \sin(8x)}$$

$$\int \frac{-2 - 4 \sin(8x)}{u} \cdot \frac{du}{4 + 8 \sin(8x)}$$

$$\int \frac{-2(1 + 2 \sin(8x))}{u} \cdot \frac{du}{4(1 + 2 \sin(8x))}$$

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

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

$$-\frac{1}{2} \ln |4x - \cos(8x)| + C$$