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Complete the following problems. Show all work to receive full credit.

$$\begin{aligned} 1. \int \frac{(\ln x)^2}{x} dx \\ = \frac{1}{3} (\ln x)^3 + C \end{aligned}$$

$$\begin{aligned} 2. \int \frac{\tan^{-1} x}{1+x^2} dx \\ = \frac{1}{2} (\tan^{-1} x)^2 + C \end{aligned}$$

$$\begin{aligned} 3. \int \frac{(1+\sqrt{x})^9}{\sqrt{x}} dx \\ = \frac{1}{5} (1+\sqrt{x})^{10} + C \end{aligned}$$

$$\begin{aligned} 4. \int \sec x \tan x \sqrt{1+\sec x} dx \\ = \frac{2}{3} (1+\sec x)^{\frac{3}{2}} + C \end{aligned}$$

$$\begin{aligned} 5. \int \cos x \cos(\sin x) dx \\ = \sin(\sin x) + C \end{aligned}$$

$$\begin{aligned} 6. \int \sec^4 x \tan x dx \\ = \int \sec^3 \sec x \tan x dx \\ = \frac{1}{4} \sec^4 x + C \end{aligned}$$

$$7. \int \sin^5 \theta d\theta$$

$$\begin{aligned} &= \int \sin \theta \sin^4 \theta d\theta \\ &= \int \sin \theta (1 - \cos^2 \theta)^2 d\theta \\ &= \int \sin \theta (1 - 2 \cos^2 \theta + \cos^4 \theta) d\theta \\ &= \int \sin \theta - 2 \sin \theta \cos^2 \theta + \sin \theta \cos^4 \theta d\theta \\ &= -\cos \theta + \cos^3 \theta - \cos^5 \theta + C \end{aligned}$$

$$8. \int \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx$$

$$= (\sin^{-1} x)^2 + C$$

$$9. \int x e^{-x^2} dx$$

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

$$10. \int \cos x dx$$

$$= \sin x + C$$

$$11. \int \frac{3}{(2-x)^2} dx$$

$$= 3(2-x)^{-1} + C$$

$$12. \int \tan x dx$$

$$= \ln |\sec x| + C$$

$$13. \int \frac{1}{\sqrt{1-3x}} dx$$

$$= -\frac{2}{3} (1-3x)^{\frac{1}{2}} + C$$

$$14. \int \frac{1}{\sqrt{1-9x^2}} dx$$

$$\begin{aligned} &= \int \frac{1}{\sqrt{1-(3x)^2}} dx \\ &= \frac{1}{3} \sin^{-1}(3x) + C \end{aligned}$$

$$15. \int (e^{-x} + 4^x) dx$$

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

$$16. \int (\cos^2 x + \sin^2 x) dx$$

$$= \int 1 dx \\ = x + C$$

$$17. \int \pi dx$$

$$= \pi x + C$$

$$18. \int \frac{4}{x + x \ln^2 x} dx$$

$$= \int \frac{4}{x(1 + (\ln x)^2)} dx \\ = \int \frac{4 \cdot \frac{1}{x}}{1 + (\ln x)^2} dx \\ = \tan^{-1}(\ln x) + C$$

$$19. \int \frac{x^2 + 4}{x} dx$$

$$= \int x + \frac{4}{x} dx \\ = \frac{1}{2}x^2 + 4 \ln |x| + C$$

$$20. \int \frac{\csc \theta}{\csc \theta - \sin \theta} d\theta$$

$$= \int \frac{1}{\sin \theta} \cdot \frac{1}{\csc \theta - \sin \theta} d\theta \\ = \int \frac{1}{1 - \sin^2 \theta} d\theta$$

$$21. \int \frac{e^x}{1 + e^{2x}} dx$$

$$= \int \frac{e^x}{1 + (e^x)^2} dx \\ = \tan^{-1}(e^x) + C$$

$$22. \int x^{-2} + x^3 + 2x + 5dx$$

$$= -x^{-1} + \frac{1}{4}x^4 + x^2 + 5x + C$$

$$23. \int e^x + x^e + edx$$

$$= e^x + \frac{1}{e+1}x^{e+1} + ex + C$$

$$24. \int \frac{1}{x}dx$$

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

$$25. \int 3 \sin x - 5 \cos x dx$$

$$= -3 \cos x - 5 \sin x + C$$

$$26. \int x(x^2 - 3)^{49} dx$$

$$= \frac{1}{100} (x^2 - 3)^{50} + C$$

$$27. \int \frac{x-2}{x^2-4x} dx$$

$$\begin{aligned} &= \frac{1}{2} \int \frac{2(x-2)}{x^2-4x} dx \\ &= \frac{1}{2} \ln |x^2 - 4x| + C \end{aligned}$$

$$28. \int x \sin(x^2) dx$$

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