HOMEWORK 5: § 8.1 # 3, 4, 7, 8, 10, 12, 17, 33 : CALC. II (STEWART 6th Ed)

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§ 8.1 # 3

$$\int \underbrace{x}_{u}\,\underbrace{\cos(5x)\,dx}_{dV} = \frac{1}{5}x\sin(5x) - \int \frac{1}{5}\sin(5x)\,dx$$

$$= \boxed{\frac{1}{5}x\sin(5x) + \frac{1}{25}\cos(5x) + C}$$

§ 8.1 # 4

$$\int \underbrace{x}_{u}\,\underbrace{e^{-x}\,dx}_{dV} = -xe^{-x} + \int e^{-x}\,dx$$

$$= \boxed{-xe^{-x} - e^{-x} + C}$$

§ 8.1 # 7

$$\int \underbrace{x^2}_{u}\,\underbrace{\sin(\pi x)\,dx}_{dV} = x^2\left(\frac{-1}{\pi}\cos \pi x\right) + \int \frac{1}{\pi}\cos(\pi x)\,2x\,dx$$

$$= -\frac{x^2}{\pi}\cos \pi x + \int \underbrace{\frac{2x}{\pi}}_{u}\,\underbrace{\cos(\pi x)\,dx}_{dV}$$

$$= -\frac{x^2}{\pi}\cos \pi x + \frac{2x}{\pi^2}\sin(\pi x) - \int \frac{2}{\pi^2}\sin(\pi x)\,dx$$

$$= \boxed{-\frac{x^2}{\pi}\cos \pi x + \frac{2x}{\pi^2}\sin(\pi x) + \frac{2}{\pi^3}\cos(\pi x) + C}$$

§ 8.1 # 8

$$\int \underbrace{x^2}_{u}\,\underbrace{\cos(mx)\,dx}_{dV} = \frac{1}{m}x^2\sin(mx) - \int \underbrace{\frac{2x}{m}}_{u}\,\underbrace{\sin(mx)\,dx}_{dV}$$

$$= \frac{1}{m}x^2\sin(mx) + \frac{2x}{m^2}\cos(mx) - \int \frac{1}{m}\cos(mx)\,\frac{2}{m}\,dx$$

$$= \boxed{\frac{x^2}{m}\sin(mx) + \frac{2x}{m^2}\cos(mx) - \frac{2}{m^3}\sin(mx) + C}$$

§ 8.1 # 10

$$\int \underbrace{\sin^{-1}(x)}_{u}\,\underbrace{dx}_{dV} = x\sin^{-1}(x) - \int \frac{x\,dx}{\sqrt{1-x^2}} \quad : \quad \left[\begin{array}{l} u = 1-x^2 \\ du = -2x\,dx \end{array}\right]$$

$$= x\sin^{-1}(x) - \int \frac{1}{\sqrt{u}}\left(\frac{-1}{2}\,du\right)$$

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

§ 8.1 # 12

$$\int \underbrace{p^5}_{dV} \underbrace{\ln(P)}_{u} \underbrace{dP}_{dV} = \frac{1}{6}P^6 \ln(P) - \int \frac{1}{6} P^6 \frac{dP}{P}$$

$$= \frac{P^6}{6}\ln(P) - \frac{1}{6}\int P^5 dP$$

$$= \boxed{\frac{1}{6}P^6 \ln(P) - \frac{1}{36}P^6 + C}$$

§ 8.1 # 17

$$\int \underbrace{e^{2\theta}}_{dV} \underbrace{\sin(3\theta)}_{u} \underbrace{d\theta}_{dV} = \frac{1}{2}e^{2\theta}\sin(3\theta) - \int \frac{1}{2}e^{2\theta} \cdot 3\cos(3\theta)\, d\theta$$

$$= \frac{1}{2}e^{2\theta}\sin(3\theta) - \frac{3}{2}\int \underbrace{\cos(3\theta)}_{u}\, \underbrace{e^{2\theta}d\theta}_{dV}$$

$$= \frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{2}\left[\frac{1}{2}e^{2\theta}\cos 3\theta + \int \frac{3}{2}e^{2\theta}\sin(3\theta)\,d\theta\right]$$

$$= \frac{1}{2}e^{2\theta}\left(\sin(3\theta) - \frac{3}{2}\cos(3\theta)\right) - \frac{9}{4}\int e^{2\theta}\sin 3\theta\, d\theta$$

$$\Rightarrow \frac{13}{4}\int e^{2\theta}\sin 3\theta\, d\theta = \frac{1}{2}e^{2\theta}\sin 3\theta - \frac{3}{4}e^{2\theta}\cos 3\theta + C_1$$

$$\Rightarrow \boxed{\int e^{2\theta}\sin 3\theta\, d\theta = \frac{2}{13}e^{2\theta}\sin 3\theta - \frac{3}{13}e^{2\theta}\cos 3\theta + C}$$

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§ 8.1 # 33

$$\int \cos\sqrt{x}\, dx = \int \cos(t)\cdot 2t\,dt$$

Let $t = \sqrt{x}$

$dt = \frac{dx}{2\sqrt{x}} \Rightarrow dx = 2t\,dt$

$$= \int \underbrace{2t}_{u}\, \underbrace{\cos t\, dt}_{dV}$$

$$= 2t\sin t - \int \sin t \cdot 2dt$$

$$= 2t\sin t + 2\cos t + C$$

$$= \boxed{2\sqrt{x}\,\sin\sqrt{x} + 2\cos\sqrt{x} + C}$$