HW 19

4.4 #2

$$\int_9^{12} x^{1/2}\,dx$$

$$= \frac{2}{3}\left[x^{3/2}\right]_9^{12}$$

$$= 2/3\left[12^{3/2} - 9^{3/2}\right]$$

$$= 2/3\left[24\sqrt{3} - 27\right]$$

$$= 16\sqrt{3} - 18$$

#9

$$\frac{d}{dx}\int_{x^9}^{7} \frac{\sin t}{t}\,dt$$

$$= -\frac{d}{dx}\int_{7}^{x^9} \frac{\sin t}{t}\,dt$$

$$= \cancel{\frac{d}{dx}} \quad -\left[\frac{\sin(x^9)}{x^9}\right] 9x^8$$

(Chain rule + fundamental thm of calculus)

$$= \frac{-9\sin(x^9)}{x}$$

#16 $\frac{d}{dx}\int_{-1}^{\ln x}(t^9+\tan t)\,dt$

$= \{\ln(x)^9 + \tan(\ln x)\}\cdot\frac{1}{x}$

#18 $\frac{d}{dx}\int_{x}^{x+6}\cos t\,dt$

$= \frac{d}{dx}\left[\sin(x+6) - \sin x\right]$

$= \cos(x+6) - \cos x$

4.5 #2 $\int_{e}^{e^7}\frac{9}{t\ln t}\,dt$

$u = \ln t \qquad du = \frac{1}{t}\,dt$

$\int \frac{9}{u}\,du = 9\ln u = 9\ln(\ln t)\Big]_{e}^{e^7}$

$= 9\left(\ln(\ln e^7) - \ln(1)\right)$

$= 9(\ln 7 - 0) = 9\ln 7$

#9 $\int \cos(e^x)\, e^x - e^{12x}\, dx = \int e^x [\cos e^x - e^{11x}\, dx]$

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

$\int (\cos(u) - u^{11})\, du$

$= \sin u - \frac{u^{12}}{12} + C = \sin e^x - \frac{e^{12x}}{12} + C$

#18 $\int_{-1}^{2} 4x^3 e^{x^4}\, dx$

$u = x^4 \quad du = 4x^3\, dx$

$\int e^u\, du = e^u = e^{x^4}\Big]_{-1}^{2}$

$= e^{16} - e$

#20. $\int \frac{(\ln x)^6}{x}\, dx \quad u = \ln x \quad du = \frac{1}{x}\, dx$

$= \int u^6\, du = \frac{u^7}{7} + C = \frac{(\ln x)^7}{7} + C$