Assignment 11 (SOLUTION from Textbook Manual Solution)

Text: *Calculus for the Life Sciences, S. Schreiber, K. Smith and W. Getz, Wiley, 2014*

Section 5.4

3. a. Using the evaluation theorem, we get $\int_0^4 x^2 - 1\,dx = x^3/3 - x\Big|_0^4 = 4^3/3 - 4 =$

b. Using the evaluation theorem, we get $\int_0^\pi \sin x + x\,dx = -\cos x + x^2/2\Big|_0^\pi = (-(-1) + \pi^2/2) - (-1) = \pi^2/2 + 2.$

6. a. Using the evaluation theorem, we get $\int_0^{27} \sqrt[3]{x}\,dx = (3/4)x^{4/3}\Big|_0^{27} = (3/4)27^{4/3} = 243/4.$

b. Using the evaluation theorem, we get $\int_0^1 7u^8 + \sqrt{\pi}\,du = (7/9)u^9 + \sqrt{\pi}u\Big|_0^1 = 7/9 + \sqrt{\pi}.$

Section 5.5

1. a. Using the evaluation theorem, we get $\int_0^4 2t + 4\,dt = t^2 + 4t\Big|_0^4 = 16 + 16 = 32.$

b. Using the substitution $u = 2t + 4$, $du = 2dt$ and we obtain $\int_0^4 (2t+4)^{-1/2}\,dt = \int_4^{12} (1/2)u^{-1/2}\,du = u^{1/2}\big|_4^{12} = \sqrt{12} - 2$.

4. a. Using the evaluation theorem, we get $\int_0^4 \sqrt{x}\,dx = (2/3)x^{3/2}\big|_0^4 = (2/3)4^{3/2} - 0 = 16/3$.

b. Using the substitution $u = -x$, we get $du = -dx$ and we obtain $\int_{-4}^0 \sqrt{-x}\,dx =$

18. Let $u = 2x^3 + 1$, then $du = 6x^2dx$ and $\int_0^1 (5x^2/(2x^3+1))\,dx = \int_1^3 (5/6)u^{-1}\,du = (5/6)\ln u\big|_1^3 = (5/6)\ln 3$.

20. Let $u = \ln(x+1)$; $du = (1/(x+1))dx$ and $\int_0^1 (\ln(x+1)/(x+1))\,dx = \int_0^{\ln 2} u\,du = u^2/2\big|_0^{\ln 2} = \ln^2 2/2$.

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Section 5.6

2. Let $I = \int e^t \sin t\, dt$. Choose $u = e^t$, $dv = \sin t\, dt$; then $du = e^t dt$, and $v = -\cos t$. We obtain that $I = \int e^t \sin t\, dt = -e^t \cos t + \int e^t \cos t\, dt$. For the second integration by parts, let $u = e^t$, and $dv = \cos t\, dt$; then $du = e^t\, dt$, and $v = \sin t$. Continuing, we get that $I = \int e^t \sin t\, dt = -e^t \cos t + \int e^t \cos t\, dt = -e^t \cos t + e^t \sin t - \int e^t \sin t\, dt = e^t(\sin t - \cos t) - I$. Now rearranging this equation we obtain that $I = e^t(\sin t - \cos t)/2 + C$.

3. Let $u = \ln x$, $dv = x dx$. Then $du = (1/x)dx$, $v = x^2/2$ and we obtain that $\int x \ln x\, dx = (x^2/2)\ln x - \int (x^2/2)(1/x)\, dx = (x^2/2)\ln x - x^2/4 + C$.

11. Let $u = x$, $dv = e^{-x}\, dx$. Then $du = dx$, $v = -e^{-x}$ and we obtain $\int_0^4 xe^{-x}\, dx = -xe^{-x}\big|_0^4 + \int_0^4 e^{-x}\, dx = -4e^{-4} + (-e^{-x})\big|_0^4 = -5e^{-4} + 1 \approx 0.9084$.

14. Let $u = x$, $dv = \sin x\, dx$. Then $du = dx$, $v = -\cos x$ and we obtain $\int_0^\pi x \sin x\, dx = -x\cos x\big|_0^\pi + \int_0^\pi \cos x\, dx = \pi + (\sin x)\big|_0^\pi = \pi \approx 3.1416$.