Lab Quiz 1 Solutions, Math 253 B25/B26, Wed. 1/19 , 1300 hours

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1. Calculate

$$\int \frac{\sqrt{x} + \ln(x)}{x}\,dx = \int \frac{1}{\sqrt{x}}\,dx + \int \frac{\ln(x)}{x}\,dx\Big|_{\substack{u=\ln(x)\\ du=\frac{1}{x}dx}} =$$

$$= 2\sqrt{x} + \int u\,du = 2\sqrt{x} + \frac{1}{2}u^2 + C = 2\sqrt{x} + \frac{1}{2}[\ln(x)]^2 + C.$$

2. Calculate

$$\int_0^{\pi} \cos^4(p)\,dp = \int_0^{\pi} [\cos^2(p)]^2\,dp = \int_0^{\pi} \left[\frac{1+\cos(2p)}{2}\right]^2\,dp =$$

$$= \frac{1}{4}\int_0^{\pi} [1 + 2\cos(2p) + \cos^2(2p)]\,dp = \frac{1}{4}[p|_0^{\pi} + \sin(2p)|_0^{\pi} + \int_0^{\pi} \frac{1+\cos(4p)}{2}\,dp =$$

$$= \frac{1}{4}[\pi + \frac{1}{2}(p + \frac{1}{4}\sin(4p))|_0^{\pi}] = \frac{1}{4}[\pi + \frac{\pi}{2}]$$

3. Calculate

$$\int_0^{\frac{\pi}{4}} \tan^3(r)\,dr = \int_0^{\frac{\pi}{4}} \tan(r)\tan^2(r)\,dr = \int_0^{\frac{\pi}{4}} \tan(r)[\sec^2(r) - 1]\,dr =$$

$$= \int_0^{\frac{\pi}{4}} \tan(r)\sec^2(r)\,dr\Big|_{\substack{u=\tan(r)\\ du=\sec^2(r)dr}} - \int_0^{\frac{\pi}{4}} \tan(r)(-1)\,dr =$$

$$\int_0^1 u\,du - \ln|\cos(r)|\,|_0^{\frac{\pi}{4}} = \frac{1}{2} - \ln(\frac{1}{\sqrt{2}}).$$