Solutions to Lab Quiz 1, Math 253 B29/B30, Thursday 1/20, 1600 hours

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1. Calculate

$$\int \frac{e^x + 1}{e^x + x}\, dx \,|_{\substack{u=e^x+x \\ du=e^x+1}} = \int \frac{du}{u} =$$
$$= \ln|u| + C = \ln|e^x + x| + C.$$

2. Calculate

$$\int_0^{\frac{\pi}{2}} \sin^3(u)\cos^3(u)\, du = \int_0^{\frac{\pi}{2}} \sin^3(u)\cos^2(u)\cos(u)\, du|_{\substack{v=\sin(u) \\ dv=\cos(u)du}} =$$
$$= \int_0^1 u^3[1-u^2]du = [\frac{1}{4}u^4 - \frac{1}{6}u^6]|_0^1 = \frac{1}{12}.$$

3. Calculate

$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \tan(r)\, \sec^3(r)\, dr = \int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sec^2(r)\sec(r)\tan(r)\, dr \,|_{\substack{u=\sec(r) \\ du=\sec(r)\tan(r)}} =$$
$$= \int_{\sqrt{2}}^{\sqrt{2}} u^2\, du = \frac{1}{3}u^3 \,|_{\sqrt{2}}^{\sqrt{2}} = 0.$$

One can also note at two different points that the integrand is odd and the interval is symmetric, so the integral is zero.