

Srednicki Problem 1.3

From

$$U(\Lambda)^{-1}P^\mu U(\Lambda) = \Lambda^\mu_\nu P^\nu \quad (1)$$

I have to end up with

$$[P^\mu, M^{\sigma\rho}] = i\hbar(g^{\mu\sigma}P^\rho - (\rho \leftrightarrow \sigma)) \quad (2)$$

So using $\Lambda = 1 + \delta\omega$, we have:

$$U(\Lambda)^{-1} = I - \frac{i}{2\hbar}\delta\omega_{\mu\nu}M^{\mu\nu} \quad (3)$$

which follows from $U^{-1}U = I$ and the given,

$$U(\Lambda) = I + \frac{i}{2\hbar}\delta\omega_{\mu\nu}M^{\mu\nu}. \quad (4)$$

Putting everything in, and working to first order in $\delta\omega$, I end up with

$$\frac{i}{2\hbar}\delta\omega_{\sigma\rho}[P^\mu, M^{\sigma\rho}] = \delta\omega^\mu_\nu P^\nu \quad (5)$$

I am stuck here.