Physics 6213
Homework 3

1 Problem

The following problem will be due Wed March 10, 1999. Write up the solution and hand it in at the beginning of class.

1. Starting with the transition amplitude:

$$T_{fi} = -i \int j^{\mu} \left(-\frac{g_{\mu\nu}}{q^2} \right) J^{\nu} d^4x$$

and the proton vertex factor:

$$\Gamma(q^2) = \left[F_1(q^2)\gamma^{\mu} + \frac{i\kappa F_2(q^2)}{2M} \sigma^{\mu\nu} q_{\mu} \right]$$

derive the electron-proton differential cross section:

$$\frac{d\sigma}{d\Omega} = \left(\frac{\alpha^2}{4E_i^2 \sin^4 \frac{\theta}{2}} \right) \frac{E_f}{E_i} \left[\left(F_1(q^2) - \frac{\kappa q^2}{4M^2} F_2(q^2) \right) \cos^2 \frac{\theta}{2} \right.$$
$$\left. + \frac{q^2}{2M^2} \left(F_1(q^2) + \kappa F_2(q^2) \right)^2 \sin^2 \frac{\theta}{2} \right]$$