

Homework 3

1) By working out explicitly the components of the hadronic tensor in the parton model:

$$W_{\mu\nu}(P, q) = \sum_i \int d^4k f_i(k, P) w_{\mu\nu}(q, k) \delta((k+q)^2),$$

with

$$w_{\mu\nu} = 2k_\mu k_\nu + k_\mu q_\nu + q_\mu k_\nu - g_{\mu\nu}(kq)$$

, we showed in class that the dimensionless structure function, F_1 , can be written as:

$$F_1(x) = \sum_i e_i^2 \left[\frac{\pi}{2} \int d^2k_T f_i(k, P) \right]$$

. Derive using a similar procedure an expression for the structure function F_2 .

2) Within the Infinite Momentum Frame discussed in class, derive an expression for the constant C in the cross section:

$$d\sigma(\gamma^* k \rightarrow k') = C(x, Q^2) \delta(\xi - x),$$

where $\xi = k/P$, k being the initial struck quark's momentum, k' being the quark's final momentum, P being the proton's momentum, and q the virtual photon momentum ($Q^2 = -q^2$).