C. Holowitz

Problem Set #9 P556

Due Monday 4/11/05

(1) In class we derived

$$f_{3/2}(z) \approx \frac{4}{3\sqrt{\pi}}\left[(\ln z)^{3/2} + \frac{\pi^2}{8}(\ln z)^{-1/2} + \dots\right]$$

for large z. (a) Use

$$f_{3/2}(z) = z\frac{\partial}{\partial z} f_{5/2}(z) = \frac{\partial}{\partial \ln z} f_{5/2}(z)$$

and show

$$f_{5/2}(z) \approx \frac{8}{15\sqrt{\pi}}\left[(\ln z)^{5/2} + \frac{5\pi^2}{8}(\ln z)^{1/2} + \dots\right]$$

for large z.

(b) Use $U = \frac{3}{2}PV$ and $\frac{P}{kT} = \frac{1}{\lambda^3} f_{5/2}(z)$

along with $\mu = kT\ln z \approx \epsilon_F\left[1 - \frac{\pi^2}{12}\left(\frac{kT}{\epsilon_F}\right)^2 + \dots\right]$ at low T to derive

$$U \approx \frac{3}{5} N\epsilon_F\left[1 + \frac{5}{12}\pi^2\left(\frac{kT}{\epsilon_F}\right)^2 + \dots\right].$$

② Problem 11.2 in Huang on p277.

③ Problem 11.3 on p277.

④ Problem 11.4 on p277.