Spring 2009 Physics 2170 Homework Assignment 1

Please show all work; the answer alone is not sufficient. This assignment is due Wednesday, January 21, 2009 at 12:50pm in the wood cabinet at the entrance to the physics help room (Duane G2B90).

1. (15 points): TZ&D 1.10

2. (10 points): TZ&D 1.12

3. (10 points): TZ&D 1.20

4. (15 points): The Taylor series is $f(z) = f(a) + f'(a)(z-a) + f''(a)\frac{(z-a)^2}{2!} + \cdots$. Using this:

   (a) Derive the approximation that $(1-x)^n \approx 1 - nx$.

   (b) Derive the approximation $\gamma \approx 1 + \frac{1}{2}\beta^2$ for $\beta \ll 1$.

   (c) Derive the approximation $\gamma \approx 1/\sqrt{2(\beta+1)}$ for $\beta \approx 1$.

   You may find TZ&D problem 1.24 helpful for solving problem 4 by giving the idea of using variable substitution. However, I would like you to use the actual Taylor series expansion rather than the binomial approximation for deriving these results.