

Materials Science and Engineering 405  
Prof. Mark C. Hersam, Fall 2006  
PHYSICS OF SOLIDS

Homework #3

**Due: Monday, October 16, 2006**

1.) (25 points) Griffiths, Problem 4.17

Note:  $G = \text{gravitational constant} = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$   
 $m = \text{mass of the earth} = 5.98 \times 10^{24} \text{ kg}$   
 $M = \text{mass of the sun} = 1.99 \times 10^{30} \text{ kg}$   
 $r_0 = \text{average earth-sun distance} = 1.50 \times 10^{11} \text{ m}$

2.) (25 points) Griffiths, Problem 4.19

Note: For any two operators,  $[A, B^2] = [A, B]B + B[A, B]$

3.) (25 points) Griffiths, Problem 7.7

4.) (25 points) Griffiths, Problem 6.31

Note:  $(1+x)^{-1} = 1 - x + x^2 - x^3 + x^4 - \dots$  for  $-1 < x < 1$   
 $(1+x)^{1/2} = 1 + \frac{1}{2}x - \frac{1}{2\cdot 4}x^2 + \frac{1\cdot 3}{2\cdot 4\cdot 6}x^3 - \dots$  for  $-1 < x \leq 1$

Note: For the 1-D harmonic oscillator,  $\langle \psi_{n'} | x | \psi_n \rangle = \sqrt{\frac{\hbar}{2m\omega}} (\sqrt{n'} \delta_{n, n'-1} + \sqrt{n} \delta_{n', n-1})$