Physics 3344 **Professor Scalise**
Spring 2000 **Assignment #2**

Due: 1 February 2000

Read Marion & Thornton Chapter 1, Shankar Chapter 7, 8.

1. Use MKS units throughout and give the answers both analytically and numerically. From the following four fundamental constants (and only these)

$$G = 6.67259 \times 10^{-11}\ \tfrac{\mathrm{N\cdot m^2}}{\mathrm{kg^2}} \qquad c = 2.99792458 \times 10^{8}\ \mathrm{m/s}$$
$$\hbar = 1.05457266 \times 10^{-34}\ \mathrm{J\cdot s} \qquad k_B = 1.380658 \times 10^{-23}\ \mathrm{J/K}$$

   using dimensional analysis, construct quantities with the dimensions of:

   (a) length
   (b) time
   (c) velocity
   (d) mass
   (e) energy
   (f) temperature

2. (a) In the matrix equation $\underline{\underline{D}} = \underline{\underline{A}}\ \underline{\underline{B}}\ \underline{\underline{C}}$, if $\underline{\underline{D}}$ is a 2×2 matrix, $\underline{\underline{A}}$ is a 2×5 matrix, and $\underline{\underline{C}}$ is a 2×2 matrix, what are the dimensions of $\underline{\underline{B}}$? How many rows and how many columns?

   (b) Write the matrix equation $\underline{\underline{D}} = \underline{\underline{A}}\ \underline{\underline{B}}\ \underline{\underline{C}}$ in index notation. Include limits on the sums.

3. If $\boldsymbol{x}$ is the column vector $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$, what is the result of the following matrix multiplications?

   (a) $\boldsymbol{x}\ \boldsymbol{x}^T$
   (b) $\boldsymbol{x}^T\ \boldsymbol{x}$

4. Marion & Thornton 1.2 b)

5. (a) Marion & Thornton 1.3

   (b) What is the effect of this rotation on the vector $\begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix}$?

6. Shankar 8.1.1