PHYS 4380 Quantum Mechanics I

Homework Assignment 05

Due date: October 9, 2018

Instructor: Dr. Daniel Erenso Name: _____

Mandatory problems: 1 & 5

Student signature:_____

Student Comment:_____
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Problem #	1	2	3	4	5	Score
Score	/	/	/	/	/	/100

1. Townsend 3.1, 3.8

2. Townsend 3.9

3. Townsend 3.10

4. Suppose we rotated the vector $\vec{A} = (A_x, A_y, A_z)$ by an angle φ about the y-axis and found a new vector $\vec{A}' = \left(A'_x, A'_y, A'_z\right)$. The projection of the vector $\vec{A}$ on the x-z plane makes an angle θ from the positive z-axis (try to make 3D vectors visualization like the one in Fig.**??** in my note). .Show that the rotation matrix is given by
$$R(\varphi j) = \begin{bmatrix} \cos(\varphi) & 0 & \sin(\varphi) \\ 0 & 1 & 0 \\ -\sin(\varphi) & 0 & \cos(\varphi) \end{bmatrix}. \tag{1}$$

5. Following the same approach we followed in class show that
$$\left[\hat{J}_z, \hat{J}_x\right] = i\hbar \hat{J}_y$$