

PHYSICS 501 – Fall 2019

2nd HOMEWORK

Dr. V. Lempesis

Hand in by Monday 7th October 2019 at 23:59

1. Calculate the quantity $\vec{\nabla} \cdot \mathbf{r}r^{n-1}$ (Hint: See question 2.10).

(5 marks)

2. Show that if a vector \mathbf{A} is irrotational, then $\mathbf{A} \times \mathbf{r}$ is solenoidal.

(5 marks)

3. Classically the angular momentum is defined by $\mathbf{L} = \mathbf{r} \times \mathbf{p}$, where \mathbf{p} is the momentum. To go from classical mechanics to quantum mechanics we replace \mathbf{p} with the operator $-i\hbar\vec{\nabla}$. Find the Cartesian components of the angular momentum operator.

(5 marks)

4. Show the relation $\mathbf{L} \times \mathbf{L} = i\hbar\mathbf{L}$ for the quantum mechanical angular momentum operator \mathbf{L} . (Hint: Show first that $(\mathbf{L} \times \mathbf{L})_x = i\hbar L_x$, i.e. work for the x-component, the other components go similarly).

(5 marks)

For the girls: Please send your answers in pdf form (typed or in clearly handwritten form) in my email address (vlempesis@ksu.edu.sa). Please use ONE file for your entire homework NOT one file per page. Please do not forget to put your name and your ID number on it)

Your deadline is on Monday 7th October 2019 at 23:59.