

**PHYSICS 501**  
**2<sup>nd</sup> HOMEWORK**  
**Dr. V. Lempesis**

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

(5 marks)

2. Prove that  $\vec{\nabla} \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot \vec{\nabla} \times \mathbf{A} - \mathbf{A} \cdot \vec{\nabla} \times \mathbf{B}$ .

(5 marks)

3. Prove that  $(\vec{\nabla} u) \times (\vec{\nabla} v)$  is solenoidal where  $u$  and  $v$  are differentiable scalar functions.

(5 marks)

4. From the Navier-Stokes equation for the steady flow of an incompressible viscous fluid we have the term

$$\vec{\nabla} \times [\mathbf{v} \times (\vec{\nabla} \times \mathbf{v})]$$

where  $\mathbf{v}$  is the fluid velocity. Show that this term vanishes for the special case  $\mathbf{v} = v(y, z)\mathbf{i}$ .

(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 AND on your file name. Your deadline is on Sunday 14<sup>th</sup> October 2018 at 23:59.**

**For the boys: You will hand in your homework in hard copy in our class on Monday 15<sup>th</sup> October.**