

## Physics 235, Homework Set 01

**Write the following text on the front cover of your homework assignment and sign it. If the text is missing, 20 points will be subtracted from your homework grade.**

### Honor Pledge for Graded Assignments

"I affirm that I have not given or received any unauthorized help on this assignment, and that this work is my own."

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Signature \_\_\_\_\_

1. Find the transformation matrix that rotates a rectangular coordinate system through an angle of  $120^\circ$  about an axis making equal angles with the original three coordinate axes.
2.  $\vec{X}$  is an unknown vector satisfying the following relations involving known vectors  $\vec{A}$  and  $\vec{B}$  and the scalar  $\phi$ :

$$\vec{A} \times \vec{X} = \vec{B}$$

$$\vec{A} \cdot \vec{X} = \phi$$

Express  $\vec{X}$  in terms of  $\vec{A}$ ,  $\vec{B}$ ,  $\phi$ , and the magnitude of  $\vec{A}$ .

3. Find the value of  $\alpha$  needed to make the following transformation orthogonal.

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & \alpha & -\alpha \\ 0 & \alpha & \alpha \end{pmatrix}$$

4. Show that

$$\bar{\nabla}(\ln|\vec{r}|) = \frac{1}{r^2}\vec{r}$$

5. Find the value of the integral

$$\int_S (\bar{\nabla} \times \vec{A}) \cdot d\vec{a}$$

if the vector  $\vec{A}$  is equal to

$$\vec{A} = y\hat{i} + z\hat{j} + x\hat{k}$$

and the surface  $S$  is defined by the paraboloid

$$z = 1 - x^2 - y^2$$

where  $z \geq 0$ .