

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."

Signature _____

1. Find the transformation matrix that rotates a rectangular coordinate system through an angle of 120° 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 ϕ :

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

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

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

3. Find the value of α needed to make the following transformation orthogonal.

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

4. Show that

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

5. Find the value of the integral

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

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 $z \geq 0$.