

Physics-305
Homework Set (2)

This homework set is due on Thursday, 4th Dhul-Hijjah, 1436 (Sept. 17th, 2015) at 10.00 p.m. [slip under my Office (15-3100) door, if needed].

For this homework set in particular, please do not discuss with your colleagues; rather, e-mail me or call me if you need help.

Start each question on a new page. Please solve fully and clearly, state assumptions, circle final answers, and comment wisely (when applicable).

Question #1:

A function in Cartesian coordinates is described by:

$$f(\mathbf{x}) = (3x^2y) \hat{x} - (y^2) \hat{y} - (xz^3) \hat{z}$$

- a- Analytically calculate the curl of f .
- b- Sketch the parallelepiped with corners at: $(0,0,0)$, $(4,0,0)$, $(4,0,2)$, $(4,3,2)$, $(4,3,0)$, $(0,3,2)$, $(0,3,0)$, and $(0,0,2)$.
- c- Confirm Stokes' theorem, applied to f on the parallelepiped "top" and "front" surfaces.

Question #2:

Design a divergence-less vector field described, in spherical polar coordinates, to have a value of $10 \hat{\theta}$ at the point $(1, \pi/2, \pi/2)$, and a curl of $8 \hat{\phi}$ at the same point.

Use a suitable computer package to show how this vector field looks like close to the Cartesian coordinate $(0,1,0)$.

Question #3:

Your textbook Chapter 1-Problem 47

Question #4:

Your textbook Chapter 1-Problem 49 [one method is sufficient]

Question #5:

If the constant electric field in the below has a magnitude $E = 25 \text{ N/C}$, calculate the electric flux through the curved surface of the hemisphere (half a sphere of radius $R = 5.0 \text{ cm}$).

