

PHYS2063 Wave Physics Homework #11 Due Tuesday 4 Oct 2022

This homework assignment is due at the start of class on the date shown. You may submit a PDF of your solutions to the Canvas page for the course, or bring a paper copy to class.

These are simple exercises to give you some practice in vector operations. I am pretty sure that you've already seen this material in your calculus classes. You might find it handy to refer to Chapter Four in the "Concepts" book.

I think it is best if you do these problems by hand, although you can check your answers with MATHEMATICA if you like.

(1) Find a vector \vec{v} that is perpendicular to the vector $\vec{w} = 2\hat{i} + 1\hat{j}$, also lying in the xy plane, and that has unit length.

(2) Find a vector \vec{v} that is perpendicular to the vectors $\vec{u} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{w} = 2\hat{i} + 4\hat{j} - 3\hat{k}$, and that has unit length.

For the following problems, use the gradient operator in Cartesian coordinates, that is

$$\vec{\nabla} = \hat{i} \frac{\partial}{\partial x} + \hat{j} \frac{\partial}{\partial y} + \hat{k} \frac{\partial}{\partial z}$$

(3) Find the gradient $\vec{\nabla}F$ for the field $F(x, y, z) = x^2yz^{1/2}$.

(4) Find the divergence $\vec{\nabla} \cdot \vec{E}$ for the vector field

$$\vec{E}(x, y, z) = \frac{\hat{i}x + \hat{j}y + \hat{k}z}{(x^2 + y^2 + z^2)^{3/2}}$$

(5) Find the curl $\vec{\nabla} \times \vec{B}$ for the vector field

$$\vec{B}(x, y, z) = -\hat{i} \frac{y}{x^2 + y^2} + \hat{k} \frac{x}{x^2 + y^2}$$