Problem Set #1
Physics 302

Tuesday, 23 January 2024

The following problems come from *Vibrations and Waves* (1971), by AP French.

- Problem 1-1 on page 16 $\Rightarrow$ (*10 points*) This is a straightforward problem in which you prove a result we will use often.
- Problem 1-2 on page 16 $\Rightarrow$ (*10 points*) This is similar to the first problem, except you examine division instead of multiplication.
- Problem 1-3 on page 16 $\Rightarrow$ (*15 points*) You prove in this problem a claim made near the bottom of page 14. Begin with $z = x + j\,y$, then multiply by $e^{j\theta}$ to get $z' = z\,e^{j\theta}$. Write $z' = x' + j\,y'$, show that z and z' have the same magnitude, and then prove that z has been rotated by the angle θ. After you have finished the problem, write the following:

  $$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} * & * \\ * & * \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} .$$

  What are the elements of the 2×2 matrix containing the stars in the above equation? Have you seen that matrix before? If so, what is it?
- Problem 1-4 on page 16 $\Rightarrow$ (*10 points*) Be sure to make a good vector diagram for part (a). To do so, think about the equation $dz = j\,z\,d\theta$. Start with z in a sketch. What does multiplying by $d\theta$ do to z? What does multiplying by j do to $z\,d\theta$?
- Problem 1-10 on page 17 $\Rightarrow$ (*10 points*) There is a typo in the first line of the problem statement: k should be replaced by k^2.
- Problem 1-12 on page 17 $\Rightarrow$ (*10 points*) Assume the point moves counterclockwise.

Due date: **Tuesday, 30 January 2024** (*beginning of class*)

Rules: You are encouraged to work together and/or consult with me. Though you may get ideas for solving problems from others, the work you turn in *must* be entirely your own. Use back-of-the-book answers (if available) for checking purposes. Simply giving an answer or copying from another student earns you *zero* points for that problem. If you use any outside sources (books, web sites, computer software, etc) for values of constants, integration tables, and other similar needs, please cite your sources. Using problem solutions found online and elsewhere constitutes an honor code violation.