Homework 1: due 1/19/22

1. If $V(t) = V_0 \cos(\omega t + \phi)$, show that $\frac{\partial V(t)}{\partial t} = Re\{j\omega V_0 \, e^{j\phi} e^{j\omega t}\}$, which can be expressed as $j\omega V$ where V is the phasor representation of $V(t)$.
2. Show that $\langle \boldsymbol{A}(t) \times \boldsymbol{B}(t) \rangle = \frac{1}{2} \, Re\{\boldsymbol{A} \times \boldsymbol{B}^*\}$ where $\boldsymbol{A}(t) = \mathrm{Re}\{\boldsymbol{A} e^{j\omega t}\}$, $\boldsymbol{B}(t) = \mathrm{Re}\{\boldsymbol{B} e^{j\omega t}\}$ and $\langle \boldsymbol{V}(t) \rangle = \frac{1}{T} \int_0^T dt \boldsymbol{V}(t)$.
3. Can the magnetic field $\boldsymbol{B} = \hat{\boldsymbol{x}} \, sin(x) + \hat{\boldsymbol{y}} \, sin(y)$ exist in the region defined by $0 \leq x \leq 1, and \; 0 \leq y \leq 1$?
4. If two opposite traveling waves are of the same frequency but with a phase difference, will a standing wave form?