# PHYS2063 Wave Physics Homework #15 Due Tuesday 18 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.*

In class, we derived the electric and magnetic fields, as a function of time, for a plane wave linearly polarized with its electric field in the $x$-direction and moving in the $z$-direction. This homework assignment concerns two variations of this solution.

**(1)** Show that the electric field, where $\omega = kc$,

$$\vec{E}(z,t) = \hat{i}E_0 \cos(kz - \omega t) + \hat{j}E_0 \sin(kz - \omega t)$$

also solves the electromagnetic wave equation for $\vec{E}(x,y,z,t)$. Find the magnetic field $\vec{B}(x,y,z,t)$, and demonstrate that $\vec{E} \times \vec{B}$ is in the right direction. Describe the behavior of the polarization of $\vec{E}(z,t)$, and come up with a name for it.

**(2)** Find a solution $\vec{E}(x,y,z,t)$ to the electric field wave equation for a plane wave linearly polarized with its electric field in the $x$-direction, but this time moving in the direction of the line $y = z$ (with $y$ and $z$ both increasing) in the $yz$ plane. Find the magnetic field $\vec{B}(x,y,z,t)$, and demonstrate that $\vec{E} \times \vec{B}$ is in the right direction.