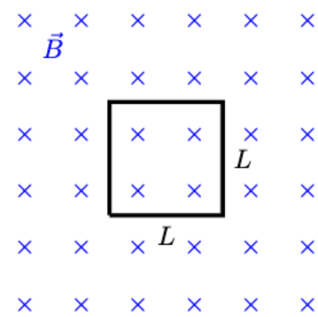
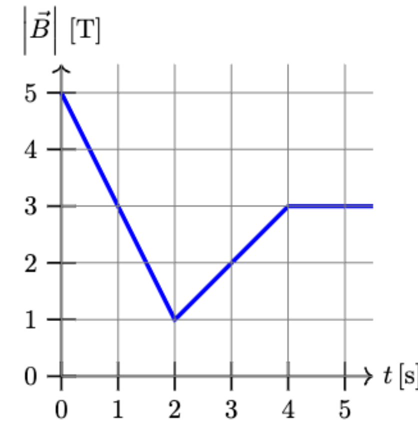
3. A square conducting loop of side-length $L = 3\,\mathrm{m}$ is in a region with a time-varying magnetic field ($\vec{B}$). The field is directed into the page, and its magnitude as a function of time is shown in the graph to the right. The total resistance of the loop is $R = 3\,\Omega$



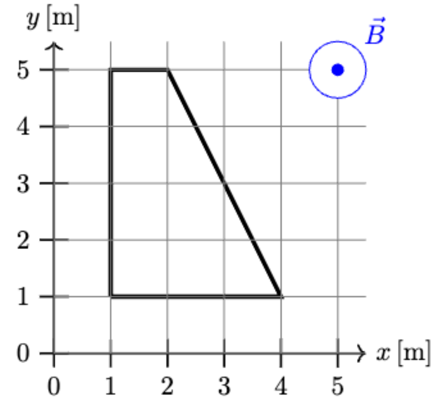


(a) Calculate the area of the loop, and specify the direction of its normal vector ($\odot$, $\otimes$).

(b) Find the magnetic flux (Φ_B) through the loop at time $t = 1\,\mathrm{s}$.

(c) Find the induced EMF ($\mathcal{E}$) in the loop at time $t = 3\,\mathrm{s}$.

3. A conducting loop of total resistance $R = 4\,\Omega$ is shown in the figure to the right. A time-dependent magnetic field is present throughout the region. The field has a magnitude given by the equation $B(t) = B_0 t + B_1$, where $B_0 = 3\,\mathrm{T/s}$ and $B_1 = 2\,\mathrm{T}$, and is directed out of the plane.



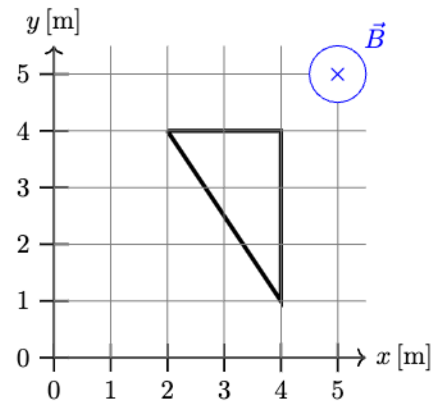
   (a) Calculate the area of the loop, and specify the direction of its normal vector ($\odot$, $\otimes$).

   (b) Find the magnetic flux through the loop at $t = 0$.

   (c) Find the induced emf $\mathcal{E}$ at time $t = 1\,\mathrm{s}$.

NAME and ID: ____ SCORE: _____ /4 points

PHY 274 PROBLEM SOLVING WORKSHOP X



1. A triangular conducting loop is shown in the figure to the right. A time-dependent magnetic field is present throughout the region. The field has a magnitude given by the equation $B(t) = B_0 t^3 + B_1$, where $B_0 = 1\,\mathrm{T/s^3}$ and $B_1 = 3\,\mathrm{T}$, and is directed into the plane.

   (a) Calculate the area of the loop, and specify the direction of its normal vector ($\odot$, $\otimes$).

   (b) Find the magnetic flux through the loop at $t = 0$.

   (c) Find the magnitude and direction (cw/ccw) of the induced emf $\mathcal{E}$ at time $t = 2\,\mathrm{s}$.

2. A conducting loop has a time-dependent area vector given by $\vec{A}(t) = (A_0 t^2 - A_1)\,\hat{k}$, where $A_0 = 1\,\mathrm{m}^2/\mathrm{s}^2$ and $A_1 = 4\,\mathrm{m}^2$ are constants. A constant magnetic field $\vec{B} = 2\,\mathrm{T}\,\hat{k}$ is present throughout the region.

   (a) Find the magnetic flux Φ_B through the loop at $t = 1\,\mathrm{s}$.

   (b) Find the induced emf $\mathcal{E}$ in the loop at time $t = 2\,\mathrm{s}$.