1. A loop of wire sits in a region of uniform but time-varying magnetic field (which is oriented orthogonally to the plane of the loop). The graph below shows the magnetic field strength as a function of time. On the same time axis, sketch the emf in the loop as a function of time. Assume a positive field is in the direction shown, and a positive emf is one that drives a current in the direction of the arrow. (4 points)

![Diagram of magnetic field and loop with emf](image)

2. When the switch is closed, what is the potential difference across the resistor R? (2 points)

![Diagram of primary and secondary coils with magnetic field](image)

3. In lecture, we demonstrated that a coil turned in the Earth's magnetic field can produce an AC current. Assume that the coil has cross sectional area 1.0 m², and is turned at 60 Hz in a magnetic field of 5.0 \times 10^{-5} T. How many turns must the coil have to produce 125 V (rms)? (4 points)

We have \( E_v = \frac{1}{2} E_{rms} = N A B \omega = N A B (2\pi f) \)

\[ N = \frac{\sqrt{2} E_{rms}}{2\pi A B f} = \frac{\sqrt{2} (125 \text{ V})}{2\pi (1 \text{ m}^2)(5.0 \times 10^{-5} \text{T})(60 \text{ Hz})} = 9378.3 \]

(But turns come in integers, so need 9379.)

REWRITE AND SIGN THE HONOR PLEDGE: “I pledge my honor that I have not