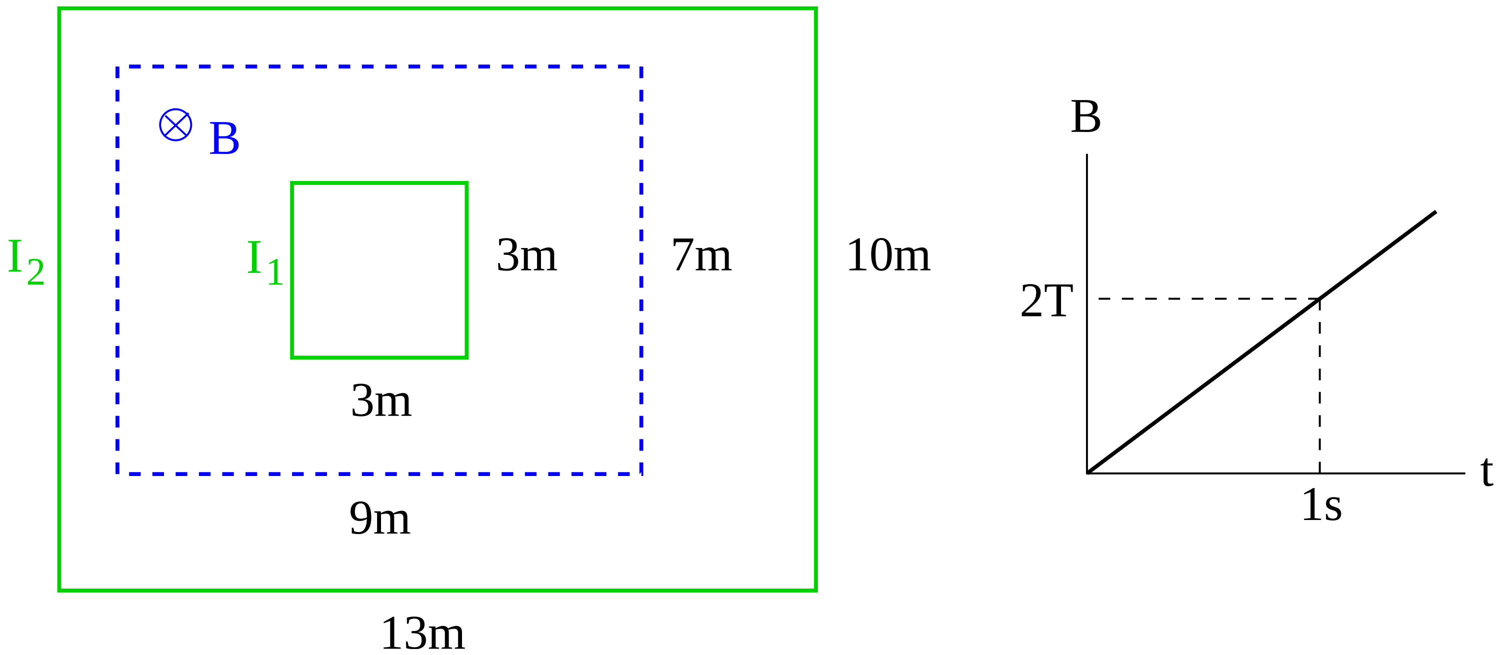
Magnetic Induction: Application (3)

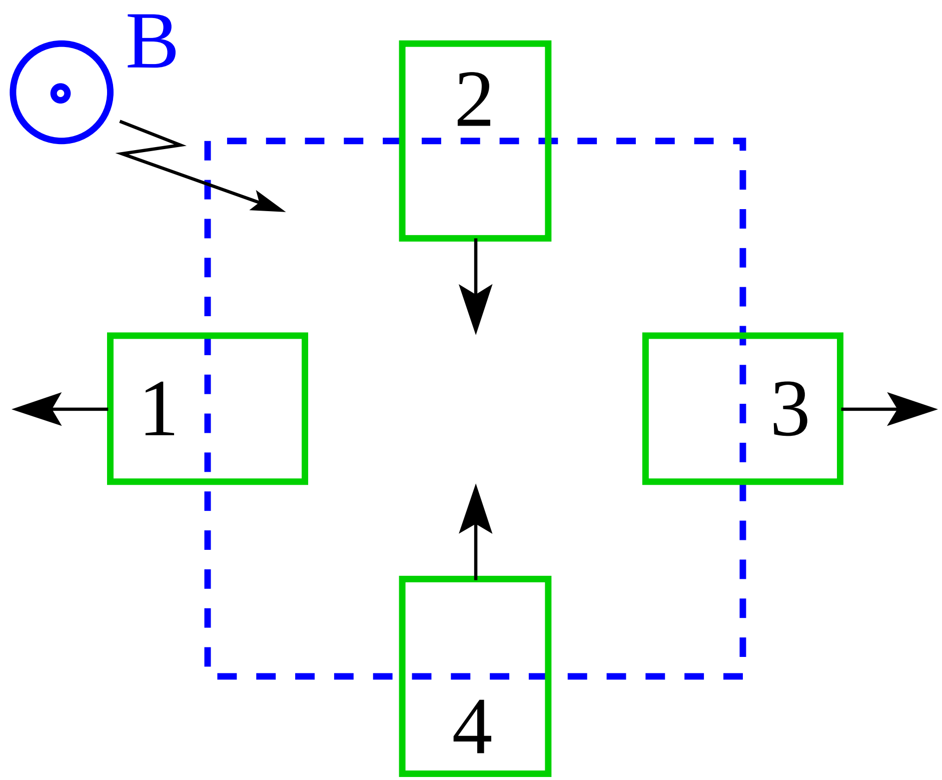
A uniform magnetic field $\vec{B}$ pointing into the plane and increasing in magnitude as shown in the graph exists inside the dashed rectangle.

- Find the magnitude (in amps) and the direction (cw/ccw) of the currents I_1, I_2 induced in the small conducting square and in the big conducting rectangle, respectively. Each conducting loop has a resistance $R = 9\Omega$



A uniform magnetic field $\vec{B}$ pointing out of the plane exists inside the dashed square. Four conducting rectangles 1,2,3,4 move in the directions indicated.

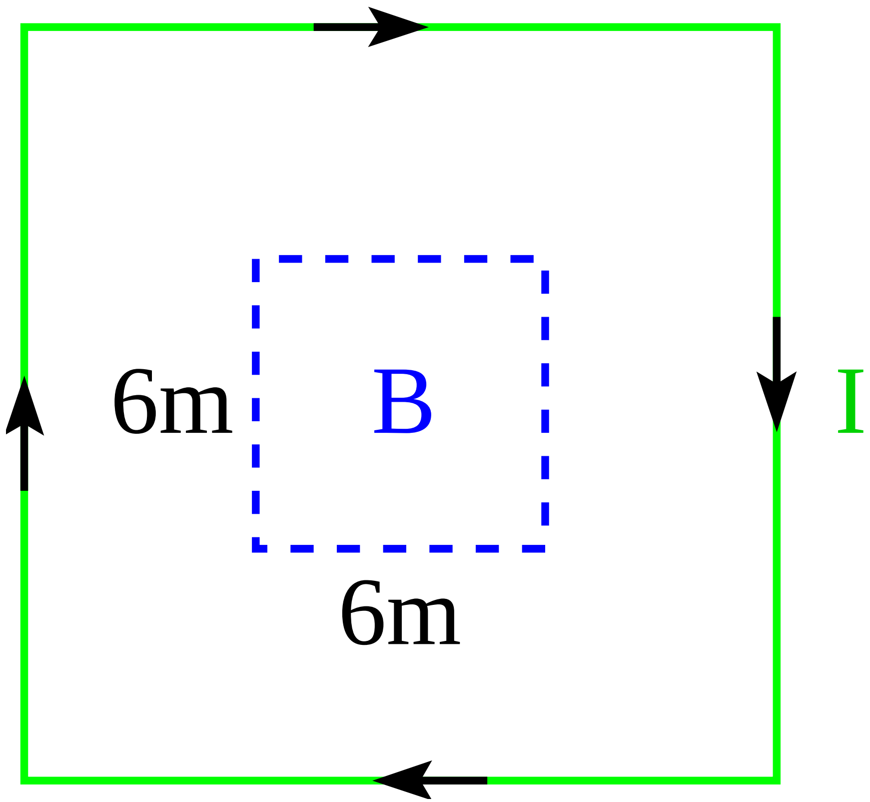
- Find the direction (cw,ccw) of the current induced in each rectangle.



Magnetic Induction: Application (4)

A magnetic field $\vec{B}$ of increasing strength and directed perpendicular to the plane exists inside the dashed square. It induces a constant clockwise current $I = 8$A in the large conducting square with resistance $R = 9\Omega$.

- If $\vec{B} = 0$ at time $t = 0$, find the direction $(\odot, \otimes)$ and magnitude of $\vec{B}$ at time $t = 5s$.



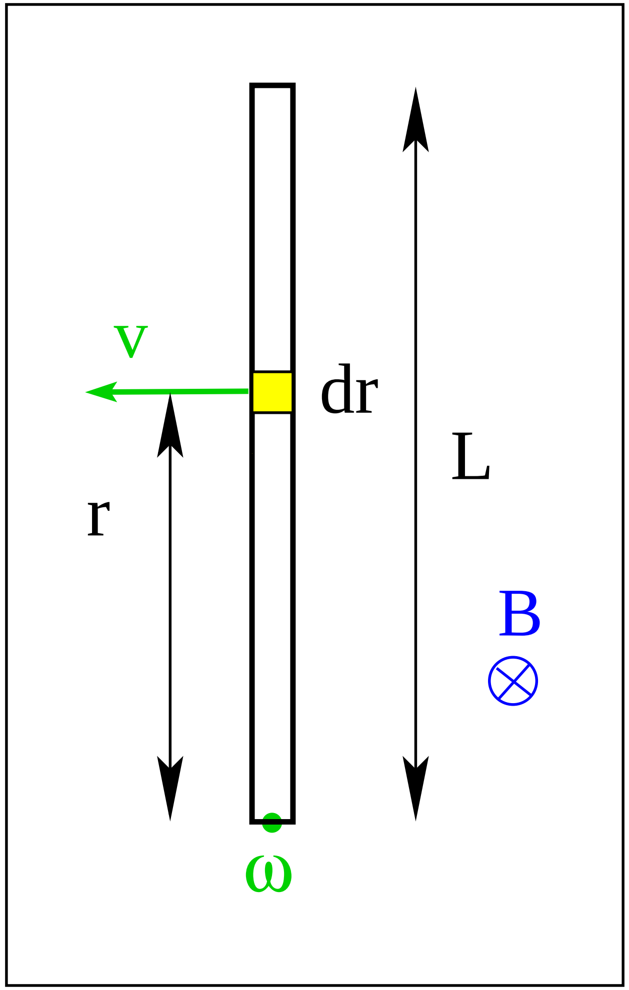
Magnetic Induction: Application (9)

Consider a conducting rod of Length L rotating with angular velocity ω in a plane perpendicular to a uniform magnetic field $\vec{B}$.

- Angular velocity of slice: ω
- Linear velocity of slice: $v = \omega r$
- EMF induced in slice: $d\mathcal{E} = Bvdr$
- Slices are connected in series.
- EMF induced in rod:

$$\mathcal{E} = \int_0^L Bv\,dr = B\omega \int_0^L r\,dr$$

$$\Rightarrow \;\mathcal{E} = \frac{1}{2}B\omega L^2 = \frac{1}{2}BvL$$



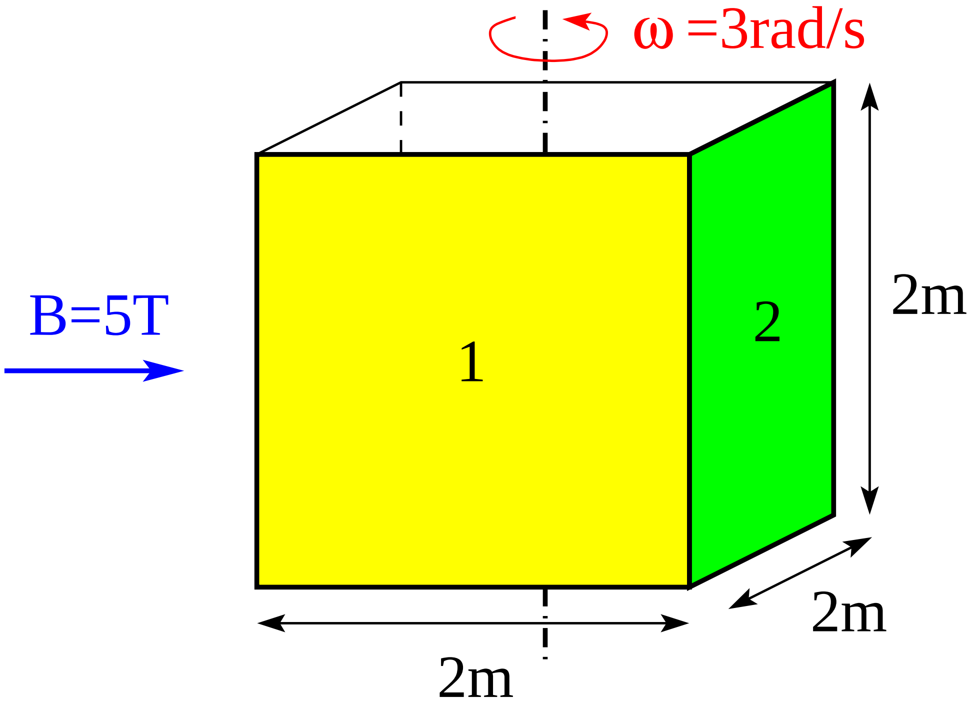
Magnetic Induction: Application (7)

The squares 1 and 2 are sides of a cube rotating about the vertical axis shown in a region of uniform horizontal magnetic field.

At the instant pictured here...

(a) find the magnetic fluxes $\Phi_B^{(1)}, \Phi_B^{(2)}$ through the two squares,

(b) find the magnitude and direction (cw,ccw) of the EMFs $\mathcal{E}_1, \mathcal{E}_2$ induced around the squares.



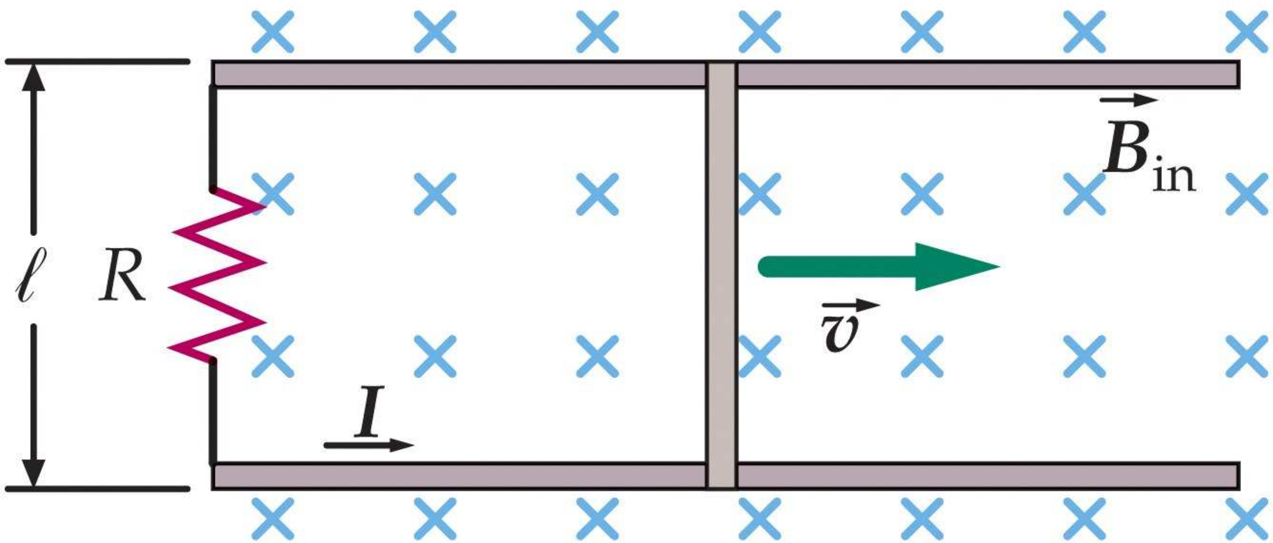
Magnetic Induction: Application (8)

Consider a rectangular loop of width ℓ in a uniform magnetic field $\vec{B}$ directed into the plane. A slide wire of mass m is given an initial velocity $\vec{v}_0$ to the right. There is no friction between the slide wire and the loop. The resistance R of the loop is constant.

(a) Find the magnetic force on the slide wire as a function of its velocity.

(b) Find the velocity of the slide wire as a function of time.

(c) Find the total distance traveled by the slide wire.



Magnetic Induction: Application (1)

Consider three metal rods of length $L = 2$m moving translationally or rotationally across a uniform magnetic field $B = 1$T directed into the plane.
All velocity vectors have magnitude $v = 2$m/s.

- Find the induced EMF $\mathcal{E}$ between the ends of each rod.