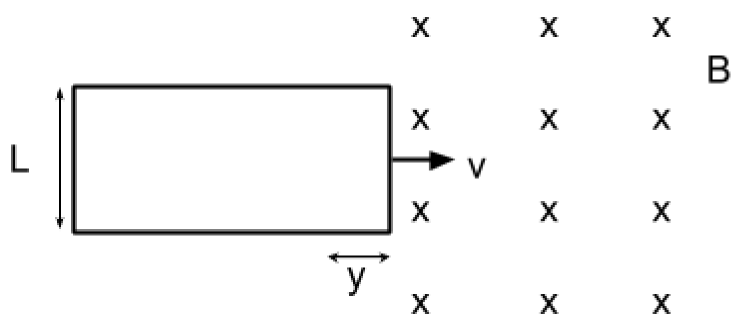
**Induction Example (determine the induced emf and current in a wire loop)**

A rectangular loop is being pushed at a constant velocity of 5 m/s into a region with a constant magnetic field of 0.2 T. Given that the loop has a length L = 25 cm and resistance R = 1 Ω, determine the direction and magnitude of the current flowing in the loop.




<u>Solution</u>

Step 1: Compute the induced emf in the loop.

Recall that: $V_{emf} = -\frac{d\phi}{dt}$ and $\phi = B \cdot A$ where B = constant and $A = L \cdot y$ (y is the horizontal segment of the loop that entered the magnetic field).

Plugging these in, we get: $V_{emf} = -\frac{d(B \cdot A)}{dt} = -\frac{B\,dA}{dt} = -\frac{Bd(L\,y)}{dt} = -BL\frac{d\,y}{dt}$
but $\frac{d\,y}{dt} = v$ therefore: $V_{emf} = -BLv$

Step 2: Related emf to current, using Ohm's law:

$I = \frac{V_{emf}}{R} \quad \Rightarrow \quad I = \frac{BvL}{R}$

Step 3: Plug in given values: $I = \frac{0.2 * 5 * 0.25}{1} = 0.25\,A$

Step 4: Use the right-hand rule to determine the direction of the current flowing in the loop.

The magnetic flux in the loop increases as the loop moves into the field region. According to Faraday's Law, with the thumb pointing out of the page, the fingers curl in the direction of the induced current, indicating the flow is counter clockwise.

**Answer: $\boldsymbol{I = 0.25\,A}$ (counter clockwise)**