Finding the flux in a loop that's not flat

21 In Fig. 30-44, a stiff wire bent into a semicircle of radius $a = 2.0$ cm is rotated at constant angular speed 40 rev/s in a uniform 20 mT magnetic field. What are the (a) frequency and (b) amplitude of the emf induced in the loop?

26 For the wire arrangement in Fig. 30-47, $a = 12.0$ cm and $b = 16.0$ cm. The current in the long straight wire is $i = 4.50t^2 - 10.0t$, where $i$ is in amperes and $t$ is in seconds. (a) Find the emf in the square loop at $t = 3.00$ s. (b) What is the direction of the induced current in the loop?

![Fig. 30-47](image)
28 In Fig. 30-49, a rectangular loop of wire with length \( a = 2.2 \) cm, width \( b = 0.80 \) cm, and resistance \( R = 0.40 \) m\( \Omega \) is placed near an infinitely long wire carrying current \( i = 4.7 \) A. The loop is then moved away from the wire at constant speed \( v = 3.2 \) mm/s. When the center of the loop is at distance \( r = 1.5b \), what are (a) the magnitude of the magnetic flux through the loop and (b) the current induced in the loop?

34 In Fig. 30-53, a long rectangular conducting loop, of width \( L \), resistance \( R \), and mass \( m \), is hung in a horizontal, uniform magnetic field \( \vec{B} \) that is directed into the page and that exists only above line \( aa \). The loop is then dropped; during its fall, it accelerates until it reaches a certain terminal speed \( v_t \). Ignoring air drag, find an expression for \( v_t \).
Figure 30-37 shows a closed loop of wire that consists of a pair of equal semicircles, of radius 3.7 cm, lying in mutually perpendicular planes. The loop was formed by folding a flat circular loop along a diameter until the two halves became perpendicular to each other. A uniform magnetic field $\vec{B}$ of magnitude 76 mT is directed perpendicular to the fold diameter and makes equal angles (of $45^\circ$) with the planes of the semicircles. The magnetic field is reduced to zero at a uniform rate during a time interval of 4.5 ms. During this interval, what are the (a) magnitude and (b) direction (clockwise or counterclockwise when viewed along the direction of $\vec{B}$) of the emf induced in the loop?

![Magnetic field diagram]

Fig. 30-37  Problem 10.