Computing the motional emf in a loop. A planar metallic wire loop moves with a velocity $\mathbf{v}$ in a nonuniform static magnetic field of flux density $\mathbf{B}$, as depicted in Fig. Q6.8. The magnetic field due to the induced current in the loop is negligible. Consider the following two expressions computed for this loop: $A_1 = -\dfrac{d}{dt}\int_S \mathbf{B}\cdot d\mathbf{S}$ and $A_2 = \oint_C (\mathbf{v}\times\mathbf{B})\cdot d\mathbf{l}$, where the reference directions of $d\mathbf{l}$ and $d\mathbf{S}$ are interconnected by the right-hand rule. Which of the following is true for the induced emf, e_{ind}, in the loop?

(A) $e_{\text{ind}} = A_1 + A_2$.
(B) $e_{\text{ind}} = A_1 - A_2$.
(C) $e_{\text{ind}} = A_1 = A_2$.
(D) $e_{\text{ind}} = A_1$ and $e_{\text{ind}} \neq A_2$.
(E) $e_{\text{ind}} = A_2$ and $e_{\text{ind}} \neq A_1$.

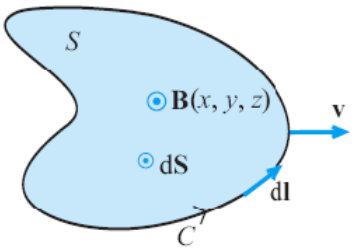

Figure Q6.8 Planar metallic wire loop moving with a velocity $\mathbf{v}$ in a time-constant magnetic field of flux density $\mathbf{B}(x, y, z)$; for Question 6.20.

Solution: (C)
Answer: (C)