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$$v dv = a dx, \quad \int_0^x dx = \int_{v_0}^v \frac{v dv}{-C_1 - C_2 v^2}$$

$$x = \frac{-1}{2C_2} \ln (C_1 + C_2 v^2) \Big|_{v_0}^v = \frac{1}{2C_2} \ln \frac{C_1 + C_2 v_0^2}{C_1 + C_2 v^2}$$

$$\text{When } v=0, \quad x=D = \frac{1}{2C_2} \ln \left(1 + \frac{C_2 v_0^2}{C_1} \right)$$