Steady state:

$$-(vC - DC')' = 0 \qquad (\dot{C} = 0)$$

No flux condition:

$$vC - DC' = 0 \quad \text{at } z \in \{0, H\}$$

$$(vC - DC' = J \quad \text{is Fick's first law})$$

By the conservation law:

$$\dot{C} + J' = 0 \overset{\dot{C}=0}{\Rightarrow} J' = 0$$

We know $J = 0$ at $z \in \{0, H\}$ but because $J' = 0$ it must hold for the whole interval. We can hence just solve

$$vC - DC' = 0$$

to get C.

$$DC' = vC \Rightarrow$$

$$C' = \frac{vC}{D} \Rightarrow$$

$$C = \frac{1}{Z} \exp\left(\frac{v}{D} z\right)$$

Z is the normalization constant which we find by

$$Z = \int_0^H \exp\left(\frac{v}{D} z\right) dz$$

$$= D/v \left(\exp\left(\frac{vH}{D}\right) - 1\right)$$