D3 A

Indefinite integral

$$\int \frac{4}{(J\,t - \mathrm{c1})^2}\,dt = \frac{4}{J\,(\mathrm{c1} - J\,t)} + \text{constant}$$

MEASURE V_L AT $t = t_L$ AT DISTANCE
$X = L$

$$L + C_2 = \frac{4}{J(C_1 - J t_L)} \tag{20}$$

$$C_1 - J t_L = \frac{4}{J(L + C_2)} \tag{21}$$

$$-J t_L = \frac{4}{J(L+C_2)} + C_1 \tag{22}$$

$$t_L = \frac{4}{-J\,J(L+C_2)} + \frac{C_1}{J} \tag{23}$$

USE (19) TO DETERMINE C_2

AT $X = 0$, $t_L = 0$

$$Q + C_2 = \frac{4}{J(C_1 - JQ)} \tag{24}$$

$$C_2 = \frac{4}{J(c_1 - 0)} = \frac{4}{J c_1} \quad 25$$

CONTINUING FROM (23)

$$t_L = \frac{-4}{J^2(L + c_2)} + \frac{c_1}{J} \quad (26)$$

PLUG (25) → (26)

$$t_L = \frac{-4}{J^2(L + 4/Jc_1)} + \frac{c_1}{J} \quad (27)$$

DISTRIBUTE J IN DENOM

$$t_L = \frac{-4}{J\left(JL + \frac{4\cancel{J}}{\cancel{J}c_1}\right)} + \frac{c_1}{J_1} \quad (28)$$

PLUG c_1 FROM (13) INTO 28

$$t_L = \frac{-4}{J\left(JL + \frac{4}{\left(\frac{-2}{\sqrt{V_m}}\right)} \frac{\sqrt{V_m}}{\sqrt{V_m}}\right)} + \frac{-2}{J\sqrt{V_m}} \quad (29)$$

$$t_L = \frac{-4}{J\left(JL - \cancel{\frac{4}{2}}\,2\sqrt{V_m}\right)} - \frac{2}{J\sqrt{V_m}} \cdot \frac{2}{2} \qquad (30)$$

$$t_L = \frac{-4}{J\left(JL - 2\sqrt{V_m}\right)} + \frac{-4}{J \; 2\sqrt{V_m}} \qquad (31)$$

$$t_L = \frac{-4}{J}\left[\frac{1}{JL - 2\sqrt{V_m}} + \frac{1}{2\sqrt{V_m}}\right] \qquad (32)$$

WE NOW KNOW t_L, TIME BULLET GETS TO ~~X~~=L.

WE MEASURE V_L. PLUG EVERYTHING INTO (17)

$$V = \frac{dy}{dt} = \frac{4}{(Jt - c_1)^2}$$ COPIED (17)

$$V_L = \frac{4}{\left[\cancel{J}\left(\frac{-4}{\cancel{J}}\right)\left\{\frac{1}{JL - 2\sqrt{V_m}} + \frac{1}{2\sqrt{V_m}}\right\} - c_1\right]^2} \qquad (33)$$