ASSUME $v = vP(t)$. THEN

$0 = \frac{d}{dt}\left(vP(t)\right) = v\frac{d}{dt}P(t) = vQP(t)$ FOR ALL $t$ $t=0$ : $\underline{0 = vQ}$

ASSUME $0 = vQ$ :

$\frac{d}{dt}\left(vP(t)\right) = v\frac{d}{dt}P(t) = vQP(t) = 0$ SO

$vP(t)$ IS CONSTANT : $vP(t) = vP(0) = v\mathrm{I} = v$