```
In[53]:= (* Defining B(0,T) *)
B = E^(-r*T)
(* Defining k *)
k = Log[(V)/(B*K)]
(* Defining Pt{No Default} *)
t = CDF[(k+(0.5*q))/(q^(1/2))] - E^(-2k)*(CDF[(-k + (0.5*q))/(q^(1/2))])
(* Defining Pv{No Default} *)
v = CDF[(k-(0.5*q))/(q^(1/2))] - E^(-2k)*(CDF[(-k - (0.5*q))/(q^(1/2))])

(* Partial Derivative of E, w.r.t V *)
a = D[(K*B*t) - (V*v),V]

(* Simplify this result *)
Simplify[a]
```

Out[53]=

Out[54]=

$$\mathsf{Log}\Big[\frac{\mathrm{e}^{\mathsf{r}\,\mathsf{T}}\,\mathsf{V}}{\mathsf{K}}\,\Big]$$

Out[55]=

$$-\frac{\text{e}^{-2\,r\,T}\,\,K^2\,\,CDF\Big[\frac{\text{0.5}\,q\text{-Log}\Big[\frac{\text{e}^{r\,T}\,\text{V}}{\text{K}}\Big]}{\text{V}^2}\,\Big]}{\text{V}^2}\,+\,CDF\Big[\frac{\text{0.5}\,q+\text{Log}\Big[\frac{\text{e}^{r\,T}\,\text{V}}{\text{K}}\Big]}{\sqrt{q}}\,\Big]$$

Out[56]=

$$-\frac{\text{e}^{-2\,r\,T}\,\,K^2\,\,CDF\left[\frac{-0.5\,q-Log\left[\frac{e^{r\,T}\,V}{K}\right]}{\sqrt{q}}\,\right]}{V^2}\,+\,CDF\left[\frac{-0.5\,q+Log\left[\frac{e^{r\,T}\,V}{K}\right]}{\sqrt{q}}\,\right]$$

Out[57]=

$$\frac{\, \mathrm{e}^{-2\, r\, T} \, \, K^2 \, \, CDF \left[\, \frac{-0.5\, q - Log \left[\frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \right]}{V^2} \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{-\, 0.5\, q \, + \, Log \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right]}{\sqrt{q}} \, \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{\mathrm{e}^{r\, T} \, v}{\kappa} \, \right] \, - \, CDF \left[\, \frac{$$

$$V \left(\frac{2 \, e^{-2 \, r \, T} \, K^2 \, CDF \Big[\frac{-0.5 \, q - Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{V^3} + \frac{e^{-2 \, r \, T} \, K^2 \, CDF' \Big[\frac{-0.5 \, q - Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V^3} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} \right) + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} \right) + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{-0.5 \, q + Log \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} \, \Big]}{\sqrt{q} \, V} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K} \Big]}{\sqrt{q}} + \frac{CDF' \Big[\frac{e^{r \, T} \, V}{K}$$

$$e^{-r\,T}\,K\left(\frac{2\;e^{-2\;r\,T}\,K^2\;CDF\Big[\frac{\theta.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big]}{V^3}\,+\,\frac{e^{-2\;r\,T}\,K^2\;CDF'\Big[\frac{\theta.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big]}{\sqrt{q}}\,+\,\frac{CDF'\Big[\frac{\theta.5\,q+Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big]}{\sqrt{q}\;V^3}\right)}{\sqrt{q}\;V^3}$$

Out[58]=

$$\begin{split} &-\frac{1}{\sqrt{q}\ V^3}\,e^{-3\,r\,T}\left(e^{r\,T}\,K^2\ \sqrt{q}\ V\,CDF\Big[\frac{-0.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] -\\ &2\,K^3\,\sqrt{q}\ CDF\Big[\frac{0.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] + e^{3\,r\,T}\,\sqrt{q}\ V^3\,CDF\Big[\frac{-0.5\,q+Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] +\\ &e^{r\,T}\,K^2\,V\,CDF'\Big[\frac{-0.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] - K^3\,CDF'\Big[\frac{0.5\,q-Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] +\\ &e^{3\,r\,T}\,V^3\,CDF'\Big[\frac{-0.5\,q+Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] - e^{2\,r\,T}\,K\,V^2\,CDF'\Big[\frac{0.5\,q+Log\Big[\frac{e^{r\,T}\,V}{K}\Big]}{\sqrt{q}}\Big] \Big] \end{split}$$