

Function definition

$$\text{In[1]:= } f_{v0, s0, T_}[v_]= \frac{v}{5 + \frac{s0+v*T}{(1-(v/v0)^4)^{0.5}}}$$

$$\text{Out[1]= } \frac{v}{5 + \frac{s0+T v}{\left(1-\frac{v^4}{v0^4}\right)^{0.5}}}$$

$$\text{In[2]:= } eqn = q - f_{v0, s0, T}[v] == 0$$

$$\text{Out[2]= } q - \frac{v}{5 + \frac{s0+T v}{\left(1-\frac{v^4}{v0^4}\right)^{0.5}}} == 0$$

Partial Derivatives from the implicit function:

$$\text{In[6]:= } Dt[eqn, v0] /. \{Dt[v, v0] \rightarrow dv dv0\}$$

Solve[%, dv dv0]

$$\text{In[10]:= } \text{First}[\%7]$$

$$\text{In[11]:= } \%10 /. \text{Rule} \rightarrow \text{Equal}$$

$\partial_{v0} v$ is as follows :

$$\text{Out[11]= } \left\{ dv dv0 == \frac{\frac{2. v^5 (s0+T v)}{\left(5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}\right)^2} - 1. Dt[q, v0] - \frac{1. v Dt[s0, v0]}{\left(5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}\right)^2} - \frac{1. v^2 Dt[T, v0]}{\left(5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}\right)^2} - \frac{1. v^4}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}}{\frac{1.}{5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}} + \frac{T v}{\left(5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}\right)^2} + \frac{2. v^4 (s0+T v)}{\left(5. + \frac{s0+T v}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}\right)^2} - \frac{1. v^4}{\left(1. - \frac{1. v^4}{v0^4}\right)^{0.5}}}$$

$$\text{In[12]:= } Dt[eqn, s0] /. \{Dt[v, s0] \rightarrow dv ds0\}$$

Solve[%, dv ds0]

$$\text{In[14]:= } \text{First}[\%13]$$

$$\text{In[15]:= } \%14 /. \text{Rule} \rightarrow \text{Equal}$$

$\partial_{s0} v$ is as follows:

$$\begin{aligned}
\text{Out[15]} = \{ & \text{dvds}\theta = - \left(\left(1. v \right) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) \right) - \\
& 1. \text{Dt}[q, s\theta] - (1. v^2 \text{Dt}[T, s\theta]) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) + \\
& (2. v^5 (s\theta + T v) \text{Dt}[v\theta, s\theta]) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{1.5} v\theta^5 \right) \Bigg) / \\
& \left(- \frac{1.}{5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}}} + (T v) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) + \right. \\
& \left. (2. v^4 (s\theta + T v)) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{1.5} v\theta^4 \right) \right) \Bigg\}
\end{aligned}$$

In[16]:= **Dt[eqn, T] /. {Dt[v, T] → dvdT}**
Solve[%, dvdT]

In[20]:= **First[Solve[%16, dvdT]] /. Rule → Equal**

$\partial_T v$ is as follows:

$$\begin{aligned}
\text{Out[20]} = \{ & \text{dvdT} = - \left(\left(1. v^2 \right) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) \right) - \\
& 1. \text{Dt}[q, T] - (1. v \text{Dt}[s\theta, T]) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) + \\
& (2. v^5 (s\theta + T v) \text{Dt}[v\theta, T]) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{1.5} v\theta^5 \right) \Bigg) / \\
& \left(- \frac{1.}{5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}}} + (T v) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5} \right) + \right. \\
& \left. (2. v^4 (s\theta + T v)) / \left(\left(5. + \frac{s\theta + T v}{\left(1. - \frac{1. v^4}{v\theta^4} \right)^{0.5}} \right)^2 \left(1. - \frac{1. v^4}{v\theta^4} \right)^{1.5} v\theta^4 \right) \right) \Bigg\}
\end{aligned}$$