In[30]:= `T[R_] := 1/(a + b * Log[R] + c * Log[R]^3)`

$$T[R\_] := \frac{1}{a + b * \mathrm{Log}[R] + c * \mathrm{Log}[R]\verb|^|3}$$

In[3]:= `D[T, R]`

Out[3]= `0`

In[27]:= **differentiate** $\frac{1}{a+b*\mathrm{Log}[R]+c*\mathrm{Log}[R]\verb|^|3}$ **with respect to R**

Assuming “Log” is the natural logarithm | Use the base 10 logarithm instead

Derivative:

Step-by-step solution

$$\frac{\partial}{\partial R}\left(\frac{1}{a + b\log(R) + c\log^3(R)}\right) = -\frac{b + 3\,c\log^2(R)}{R\left(a + b\log(R) + c\log^3(R)\right)^2}$$

$\log(x)$ is the natural logarithm »

Alternate form:

$$-\frac{b + 3\,c\log^2(R)}{R\left(a + \log(R)\left(b + c\log^2(R)\right)\right)^2}$$

Expanded form:

$$-\frac{b}{R\left(a + b\log(R) + c\log^3(R)\right)^2} - \frac{3\,c\log^2(R)}{R\left(a + b\log(R) + c\log^3(R)\right)^2}$$

Roots for the variable R:

Approximate form | Step-by-step solution

$$R = e^{-\frac{i\sqrt{b}}{\sqrt{3}\sqrt{c}}}$$

$$R = e^{\frac{i\sqrt{b}}{\sqrt{3}\sqrt{c}}}$$

Series expansion at a=0:

$$-\frac{b + 3\,c\log^2(R)}{R\left(b\log(R) + c\log^3(R)\right)^2} + \frac{2\,a\left(b + 3\,c\log^2(R)\right)}{R\left(b\log(R) + c\log^3(R)\right)^3} + O\left(a^2\right)$$

(Taylor series)

Big-O notation »

Series expansion at a=∞:

$$-\frac{b + 3\,c\log^2(R)}{a^2\,R} + \frac{2\log(R)\left(b + c\log^2(R)\right)\left(b + 3\,c\log^2(R)\right)}{a^3\,R} - \frac{3\left(\left(b + 3\,c\log^2(R)\right)\left(b\log(R) + c\log^3(R)\right)^2\right)}{a^4\,R} + \frac{4\left(b + 3\,c\log^2(R)\right)\left(b\log(R) + c\log^3(R)\right)^3}{a^5\,R} + O\left(\left(\frac{1}{a}\right)^6\right)$$

(Laurent series)

Big-O notation »

Indefinite integral:

Step-by-step solution

$$\int -\frac{b+3\,c\log^2(R)}{R\left(a+b\log(R)+c\log^3(R)\right)^2}\,da = \frac{b+3\,c\log^2(R)}{a\,R+b\,R\log(R)+c\,R\log^3(R)} + \text{constant}$$

Limit:

$$\lim_{a\to\pm\infty} -\frac{b+3\,c\log^2(R)}{R\left(a+b\log(R)+c\log^3(R)\right)^2} = 0$$

WolframAlpha

$$\frac{a\,b+3\,c\log^2(R)}{R\left(a\,b\log(R)+c\log^3(R)\right)^2}$$

In[45]:= $\dfrac{b+3\,c\log^2(R)}{R\left(a+b\log(R)+c\log^3(R)\right)^2}$

Out[45]= $\dfrac{0.0002068+2.5773\times 10^{-7}\,\text{Log}[R]^2}{R\left(0.000842+0.0002068\,\text{Log}[R]+8.591\times 10^{-8}\,\text{Log}[R]^3\right)^2}$

In[44]:= $\text{DT}[R\_,\ dR\_] := \dfrac{b+3\,c\,\text{Log}[R]^2}{R\left(a+b\,\text{Log}[R]+c\,\text{Log}[R]^3\right)^2} * dR$

```
In[23]:= a = 8.42 * 10^-4
Out[23]= 0.000842

In[32]:= b = 2.068 * 10^-4
Out[32]= 0.0002068

In[33]:= c = 8.591 * 10^-8
```

Out[33]= 8.591×10^{-8}

```
In[53]:= T[118.9 * 10^3] - 273.15


         T[119.7 * 10^3] - 273.15
Out[53]= 21.3336

Out[54]= 21.1929

In[56]:= DT[118.9 * 10^3, 0.2 * 10^3]
Out[56]= 0.0353004

In[57]:= DT[119.7 * 10^3, 0.2 * 10^3]
Out[57]= 0.0350368
```

In[87]:=
$$\Delta T[R\_, a\_, b\_, c\_, \Delta R\_, \Delta a\_, \Delta b\_, \Delta c\_] = T[R]^2 * \sqrt{\left(\frac{\partial_R T[R] * \Delta R}{T[R]^2}\right)^2 + \left(\frac{\partial_a T[R] * \Delta a}{T[R]^2}\right)^2 + \left(\frac{\partial_b T[R] * \Delta b}{T[R]^2}\right)^2 + \left(\frac{\partial_c T[R] * \Delta c}{T[R]^2}\right)^2}$$

Out[87]=
$$\frac{\sqrt{\Delta a^2 + \Delta b^2 \,\text{Log}[R]^2 + \Delta c^2 \,\text{Log}[R]^6 + \Delta R^2 \left(\frac{b}{R} + \frac{3\, c\, \text{Log}[R]^2}{R}\right)^2}}{\left(a + b\, \text{Log}[R] + c\, \text{Log}[R]^3\right)^2}$$

In[88]:= $\Delta T[R, a, b, c, dr, da, db, dc]$

Out[88]=
$$\frac{\sqrt{da^2 + db^2 \,\text{Log}[R]^2 + dc^2 \,\text{Log}[R]^6 + dr^2 \left(\frac{b}{R} + \frac{3\, c\, \text{Log}[R]^2}{R}\right)^2}}{\left(a + b\, \text{Log}[R] + c\, \text{Log}[R]^3\right)^2}$$

In[132]:= ΔT[24.1*^-3, 1.393*^-1, -2.198*^-2, 9.695*^-5, 0, 3.38*^-3, 5.016*^-4, 1.635*^-6]

Out[132]= 0.0826667

In[128]:=
$$e1[t\_, T1\_, T2\_, e2\_] = 1 - \frac{t - T1}{e2 * (T2 - T1)}$$

Out[128]=
$$1 - \frac{t - T1}{e2\,(-T1 + T2)}$$

In[131]:=
$$de1[t\_, T1\_, T2\_, e2\_, \Delta t\_, \Delta T1\_, \Delta T2\_] = \sqrt{(\partial_t e1[t, T1, T2, e2] * \Delta t)^2 + (\partial_{T1} e1[t, T1, T2, e2] * \Delta T1)^2 + (\partial_{T2} e1[t, T1, T2, e2] * \Delta T2)^2}$$

Out[131]=
$$\sqrt{\frac{\Delta t^2}{e2^2\,(-T1 + T2)^2} + \left(-\frac{t - T1}{e2\,(-T1 + T2)^2} + \frac{1}{e2\,(-T1 + T2)}\right)^2 \Delta T1^2 + \frac{(t - T1)^2\, \Delta T2^2}{e2^2\,(-T1 + T2)^4}}$$

de1[54.8, Mean[{21.336, 21.1929}], 58.343, 0.95, 0 k,
StandardDeviation[{21.336, 21.1929}] / Sqrt[2], 0.08266669356243514`]

Out[140]= 0.00606474

In[135]:= StandardDeviation[{21.336, 21.1929}] / Sqrt[2]

Out[135]= 0.07155

In[136]:= Mean[{21.336, 21.1929}]

Out[136]= 21.2645