Wanting to solve differential equations of radiation heat transfer. Reference book is Thermal Radiation Heat Transfer 5th Edition by Howell & Siegel.

Radiation from thin circular disk with hole

Guess Values

$\gamma := 1 \qquad \delta := 2$

Constraints

$$\frac{d^2}{dR^2} v(R) + \frac{1}{R + \frac{1}{(\delta - 1)}} \cdot \frac{d}{dR} v(R) - \gamma \cdot v(R)^4 = 0$$

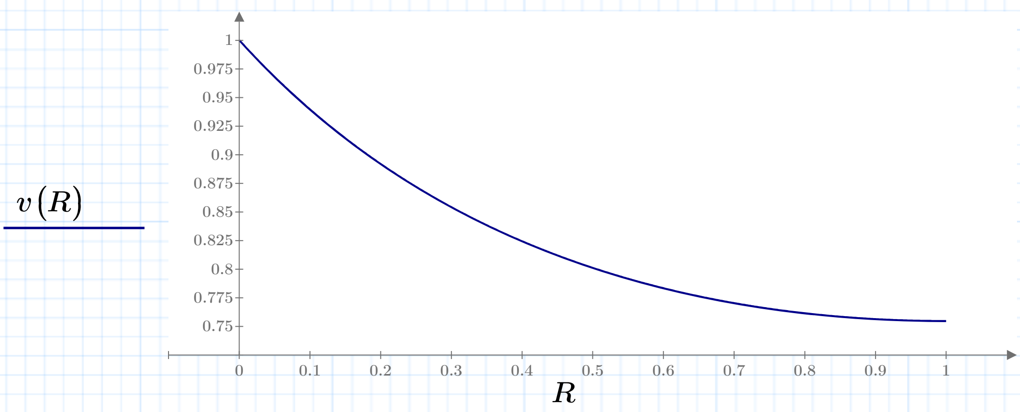
$v(0) = 1 \qquad v'(1) = 0$

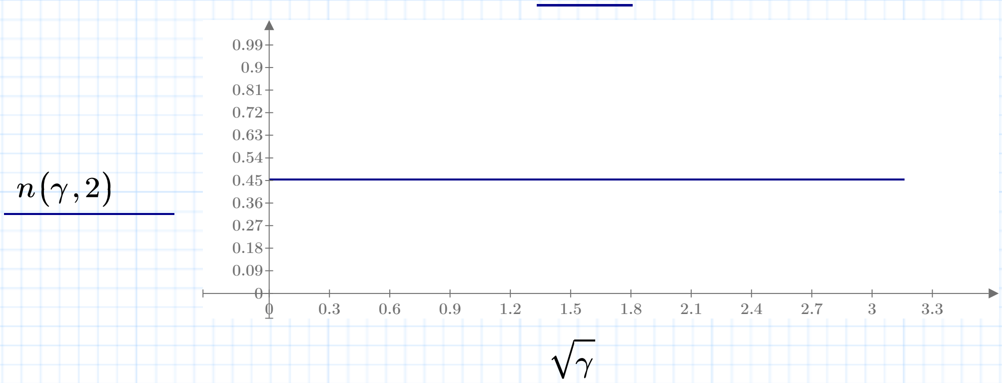
Solver

$v := \mathbf{odesolve}(v(R), 1)$

$$n(\gamma, \delta) := \frac{2 \int_0^1 (R \cdot (\delta - 1) + 1) \cdot v(R)^4 \, dR}{\delta + 1}$$

$\gamma_g := 0, 0.02 .. 4$





Take care about the labelling. The gamma in your plot was labelled "constant" and so it would not refer to a quickplot variable but to the built-in constant:

$\gamma = 577.216 \cdot 10^{-3}$

No surprise that you get a constant as n is not really dependent on gamm and delta - the arguments are not used in the function.

Radiation from thin circular disk with hole as a function of gamma and delta

Constraints

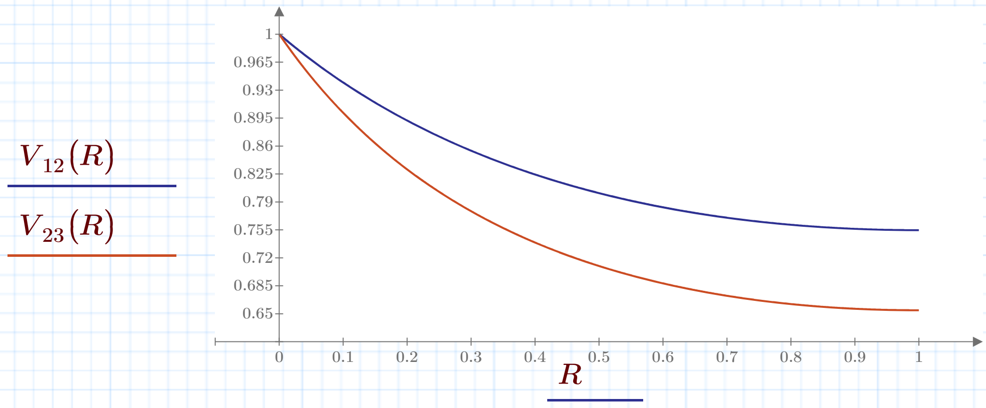
$$\frac{d^2}{dR^2}v(R)+\frac{1}{R+\frac{1}{(\delta-1)}}\cdot\frac{d}{dR}v(R)-\gamma\cdot v(R)^4=0$$

$$v(0)=1 \qquad v'(1)=0$$

Solver

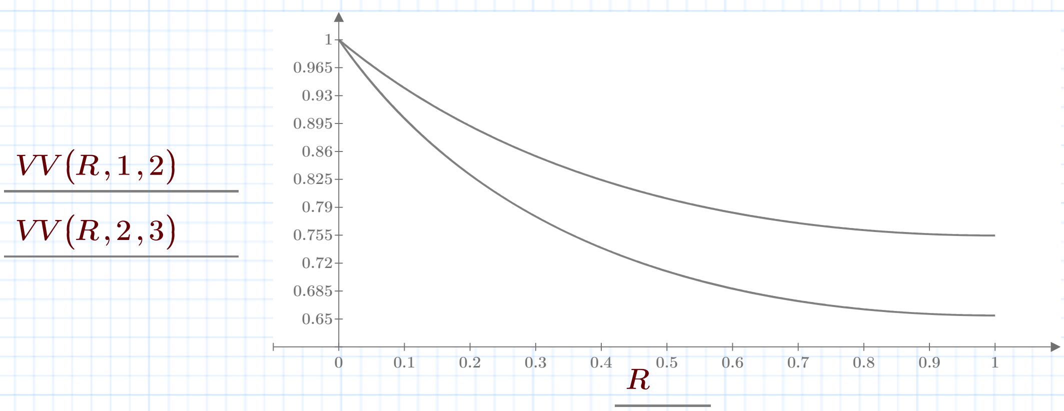
$$V(\gamma,\delta):=\mathbf{odesolve}(v(R),1)$$

$$V_{12}:=V(1,2) \qquad V_{23}:=V(2,3)$$



I strongly advise against $VV(R,\gamma,\delta):=\left\| \begin{array}{l} v\leftarrow V(\gamma,\delta) \\ v(R) \end{array} \right.$

You can think about it while you wait for the plot below to finish drawing ;-)

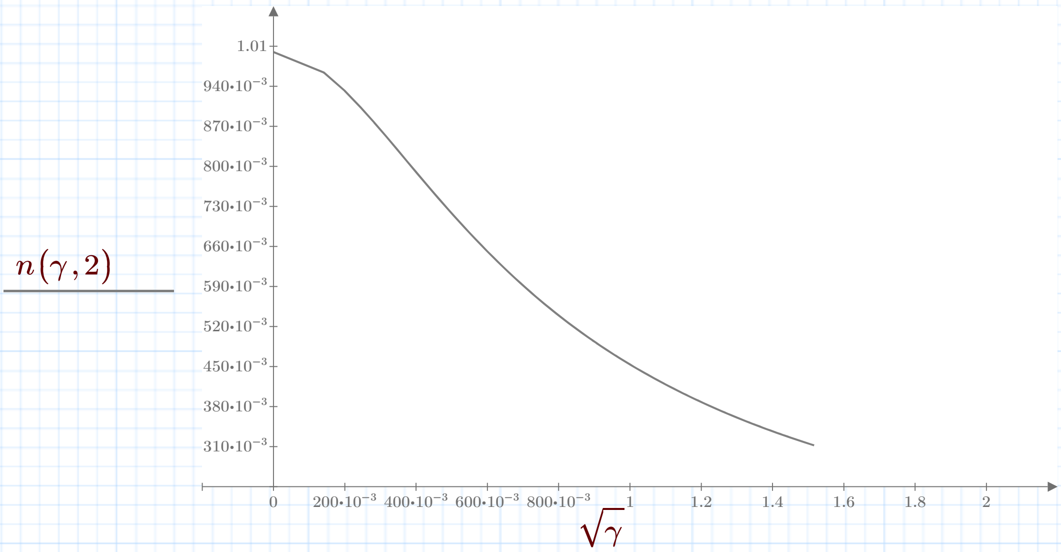


The reason for that enormous increase in calculation time is because the odesolve block gets evaluated for every single point which is plotted. You could make it a bit bearable if you provide a range variable for R with a larger step width, but it still will take a long time.

$$n(\gamma,\delta) := \frac{2\int_0^1 (R\cdot(\delta-1)+1)\cdot V(R,\gamma,\delta)^4 \,\mathrm{d}R}{\delta+1}$$

$$n(\gamma,\delta) := \left\| \begin{array}{l} V_{tmp} \leftarrow V(\gamma,\delta) \\ \dfrac{2\int_0^1 (R\cdot(\delta-1)+1)\cdot V_{tmp}(R)^4 \,\mathrm{d}R}{\delta+1} \end{array} \right.$$

$$\gamma := 0, 0.02 .. 4$$



This calculation takes quite some time but I don't see a way to avoid this. After all you need the odesolveblock to be evaluated at a lot of different gammas.

Thin Plate Heat Transfer from tube

Guess Values

$k := 10 \ \frac{W}{m \cdot K}$ $\quad q_{abs\_t} := 50 \ \frac{W}{m^2}$ $\quad q_{abs\_b} := 50 \ \frac{W}{m^2}$

$L := 5 \ m$ $\quad T_{tube} := 600 \ K$ $\quad a := 5 \cdot 10^{-3} \ m$ $\quad \varepsilon := 0.8$

Constraints

$$-k \cdot a \cdot \frac{d^2}{dx^2} T(x) + 2 \cdot \varepsilon \cdot \sigma \cdot T(x)^4 = q_{abs\_t} + q_{abs\_b}$$

$T(0 \ m) = T_{tube}$ $\quad T'(L) = \boxed{0}$

Solver

$J := \mathbf{odesolve}(T(x), L)$

Not sure but as far as I know Mathcad likes its initial condition all to be at 0.
Furthemore in Prime its most of the time necessary to add the unit even if the value is zero, so it would be 0 K/m.
I remember that there are a number of threads in the forum dealing with exactly that problem. I have not expertise here.