Fitting the Debye Heat Capacity Equation to Experimental Data for Silver

Temperature vs heat capacity for silver

```
data := Matrix([[1, 0.001], [3, 0.007], [5, 0.024], [8, 0.093], [10, 0.183],
[15, 0.670], [20, 1.647], [25, 3.066], [30, 4.774], [35, 6.612], [40, 8.419],
[45, 10.110], [50, 11.660], [55, 13.040], [60, 14.270], [65, 15.350],
[70, 16.300], [80, 17.870], [90, 19.110], [100, 20.100], [120, 21.540],
[140, 22.520], [160, 23.220], [180, 23.750], [200, 24.160], [220, 24.490],
[240, 24.760], [260, 24.990], [280, 25.190], [300, 25.370]])
```

Gas constant

```
R := 8.314
```

Debye heat capacity equation

$$F := (T, \Theta) \to 9 \cdot R \cdot \left(\frac{T}{\Theta}\right)^3 \cdot \mathrm{int}\left(\frac{x^4 \cdot \exp(x)}{(e^x - 1)^2}, x = 0 .. \frac{\Theta}{T}, \mathrm{numeric}, \mathrm{method} = \_\mathrm{Gquad}\right)$$

Find the best fit parameter value

```
Θ := Statistics:-NonlinearFit(F, data, initialvalues = [20])[1]
```

$$\Theta = 210.970$$

```
p1 := plot('F'(T, Θ), T = 1..300)
```

```
p2 := plot(data, style = point, symbol = solidcircle, color = black)
```

```
plots:-display(p1, p2) =
```