HP Prime Application Note Physics:

06. Overflow and Underflow

The overflow and underflow of most scientific and graphing calcluators is at 100^{100} and 100^{-100} respectively. You may think that these numerical limits would be sufficient for school physics but that is not true. For example, consider Stefan-Boltzmann's law which describes the relation between the radiation intensity of a star (*I*) and its temperature (*T*):

$$\boldsymbol{I = \sigma \cdot T^4}$$

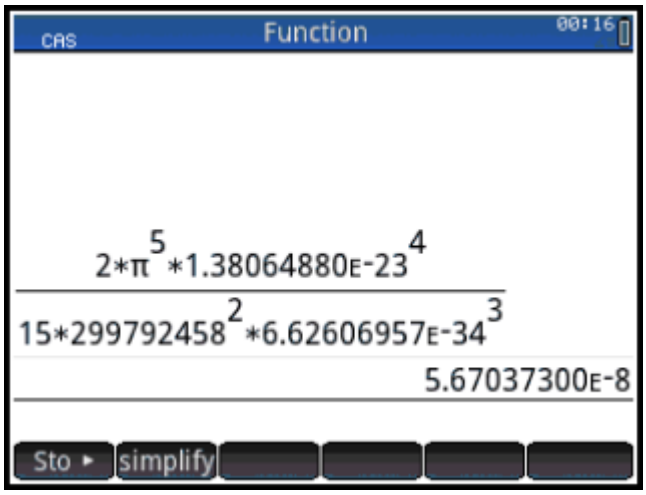
where σ is the constant of Stefan-Boltzmann ($\sigma = 5.670373 \cdot 10^{-8}\ \mathrm{Wm^{-2}K^{-4}}$).

Stefan-Boltzmann's constant is computed using the following formula:

$$\boldsymbol{\sigma = \frac{2\pi^5 \cdot k^4}{15 \cdot c^2 \cdot h^3}}$$

with Boltzmann's constant $k = 1{,}380\ 648\ 8 \cdot 10^{-23}\ \mathrm{J/K}$, the speed of light $c = 2.997\ 924\ 58 \cdot 10^{8}\ \mathrm{m/s}$, and Planck's constant $h = 6{,}626\ 069\ 57 \cdot 10^{-34}\ \mathrm{J \cdot s}$.

On an ordinary scientific calculator and most of the other graphing calculators, computing σ will result in an error prompt because $h^3 < 10^{-100}$, which exceeds the underflow. However, the HP Prime has an overflow and underflow of 100^{500} and 100^{-500} respectively. Therefore, in the HP Prime's CAS menu, the formula will yield the correct value of Stefan-Boltzmann's constant:



Verify the outcome with the value of Stefan-Boltzmann's constant listed in the HP Prime: