Plotting Variables with Units in MathCad

(Dr. Tom Co, 9/30/2008)

Introduction:

Plotting of variables having units can lead to erroneous numerical values in the plots since MathCad will attempt to use the values based on its default units. Thus care must be taken.

General Procedure:

1. Although **MathCad** offers automatic generation of x-axis values, this practice should be discouraged specially for variables containing units. Instead, one should begin by defining the range of x-axis values. For example,
$$T := 100K, 102K \ldots 300K$$

2. The variables and functions will need to be divided by the units desired. For example, suppose we want to plot $P = 2\ \text{atm}$ but in units of "inches of Hg", then in the desired placeholder, we need to input: $\frac{P}{in\_Hg}$

Remarks:

1. Since including the unit in the denominator may be confusing, it is suggested that the labels be defined and shown while the arguments of the plot are hidden.
2. Recall that for temperature in the Farenheit or Centigrade scale the following should be used:
$$\frac{T(in\ °C) - 0°C}{K} \qquad or \qquad \frac{T(in\ °F) - 0°F}{R}$$

(For $°C$ or $°F$, use **[crtl shift x]** followed by **[ctrl u]** to obtain the units-selection window.)

Example:

Plot q, the rate of heat transferred per unit area (in $\frac{BTU}{ft^2 \cdot hr}$) due to conduction, as a function of outer temperature T_{outer} (ranging from $80°F$ to $212°F$) with a fixed inner temperature $T_{innner} = 300°F$, in a material that has an average heat conductivity given by $k = 0.9\frac{BTU}{ft \cdot hr \cdot \Delta°F}$. Assume that the heat is transferred in one direction and that the distance from the inner point to the outer point is $L = 2\ ft$. The heat conduction equation is given by

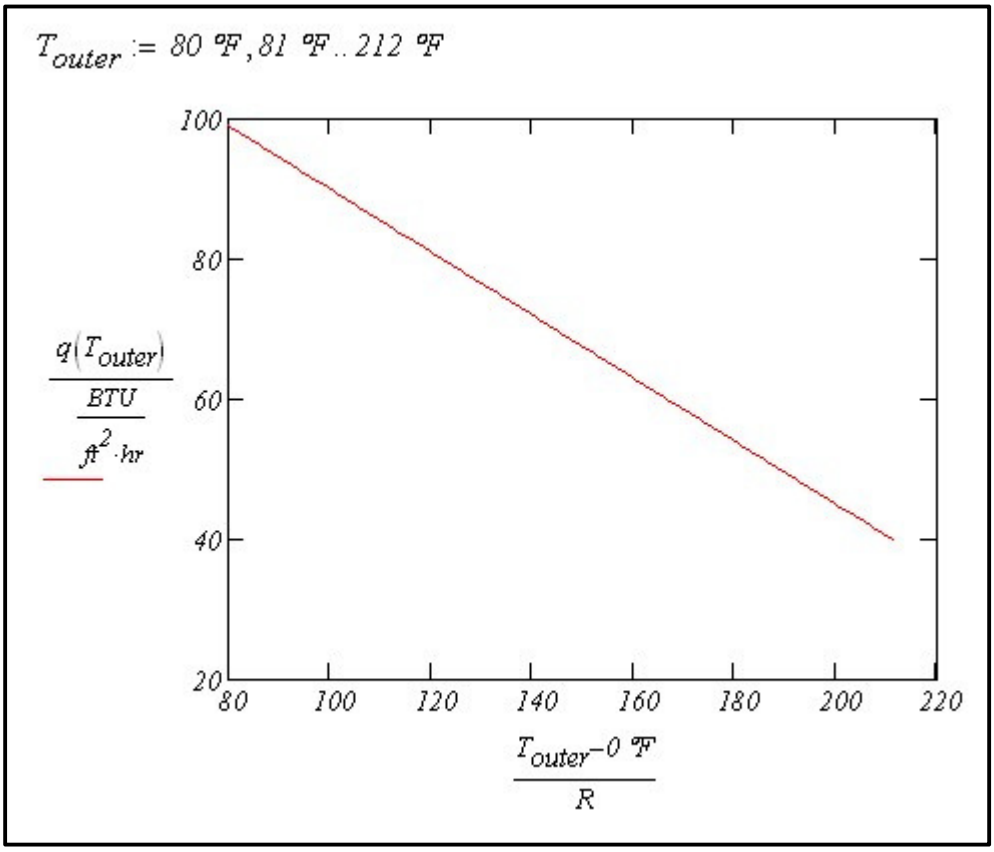
$$q = \frac{k}{L}(T_{inner} - T_{outer})$$

In MathCad, we have:

$L := 2\,ft$ $\quad k := 0.9\,\frac{BTU}{ft \cdot hr \cdot \Delta\,°F}$ $\quad T_{inner} := 300\,°F$

$q(T_{outer}) := \frac{k}{L}(T_{inner} - T_{outer})$

Then the plotting is done as follows:



(Note: It is suggested that the labels be defined and then the arguments be hidden)