

Engineering Fundamentals Linear Interpolation in Engineering

The process of interpolating between data points is a critical skill in engineering courses. Generally, this process is simple, but given the frequency you will use it during Thermo it is helpful to have a very fast way of interpolating. This hand-out will be helpful in quickly interpolating by assuming a linear relationship between data points. In Thermo, most data tables that you will use are set up so that linear interpolation will give a very close value (better than 1% in most cases).

Assume a dependent variable y is a linear function of the independent variable x

$$y = mx + b$$

Equation 1

If one knows two points (x_1, y_1) and (x_2, y_2) then m will be

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Equation 2

To find b consider the graph of y vs. x , as shown in Figure One.

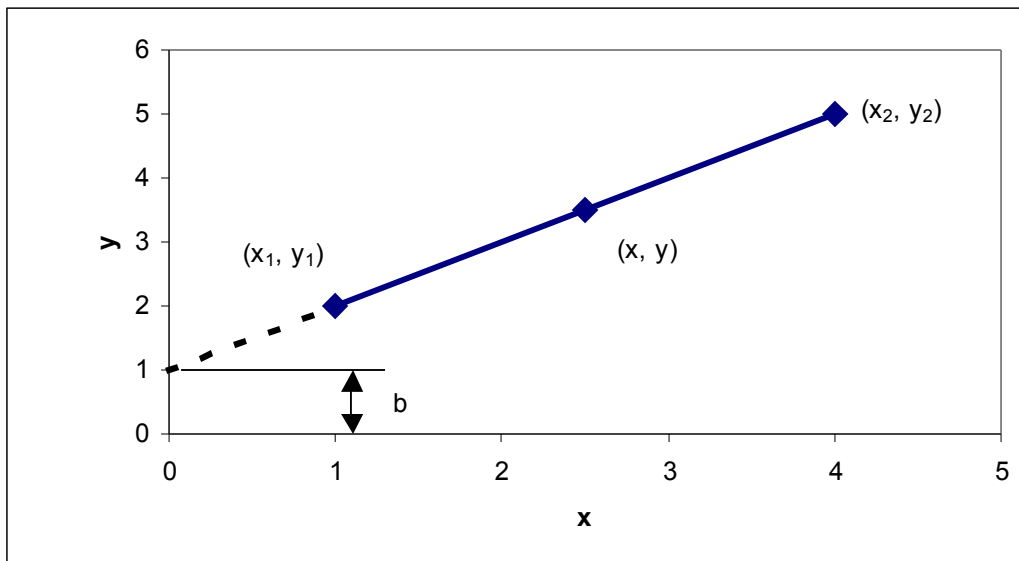


Figure One Graphical Depiction of Linear Interpolation.

So b is just

$$b = y_1 - \frac{y_2 - y_1}{x_2 - x_1} x_1$$

Equation 3

Inserting b from Eq.(3) and m from Eq.(2) back into Eq.(1) then rearranging gives

$$\frac{y_1 - y}{y_1 - y_2} = \frac{x_1 - x}{x_1 - x_2}$$

Equation 4

Now consider the usual arrangement of data within a table from which one would want to find a particular value y at a value x as shown in Table One.

Table One Tabulated values similar to many engineering tables.

x-values	y-values
x_1	y_1
x	y
x_2	y_2

Using Eq.(4) and the values in Table One the steps to obtain y are straightforward with a calculator:

1. enter the value for y_1 into your calculator,
2. store the value for y_1 in some location of your calculator,
3. subtract y_2 ,
4. multiply the result of step 3 by the right-hand side,
5. subtract y_1 from the result of step 4 (use the stored value of y_1 rather than reentering it),
6. change the sign of the result of step 5.

At the end of step six you will have the interpolated value of y . The idea with the steps shown is that in a minimum number of steps and time you will arrive at the interpolated value. Note also that if you memorize Eq.(4) that it will pretty easy after a little practice to not even write anything down in the process of getting the interpolated value.

To make interpolation even faster you can write a calculator program to interpolate for you and truly minimize the time to get an interpolated value. Some calculators come with this program built in.