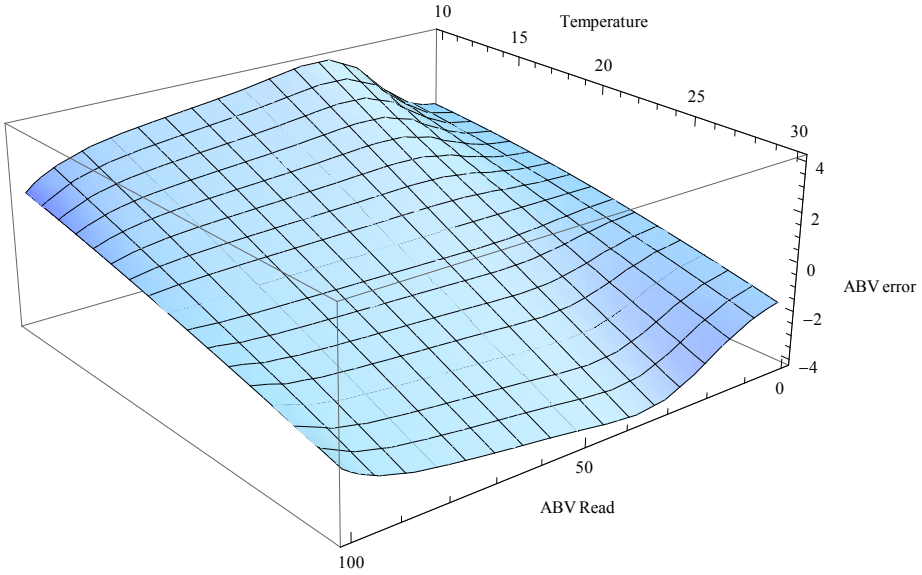
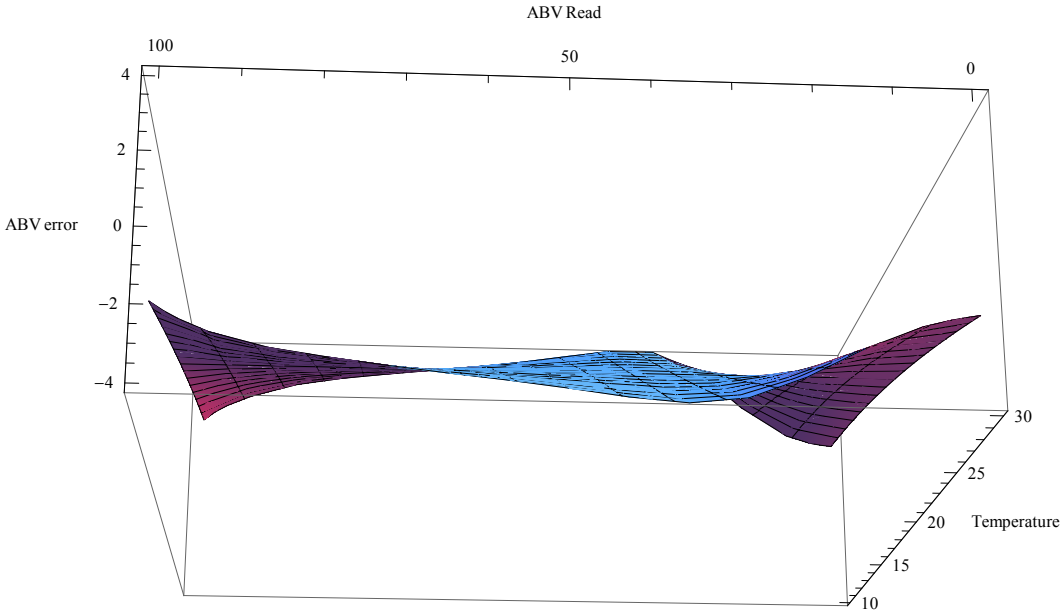
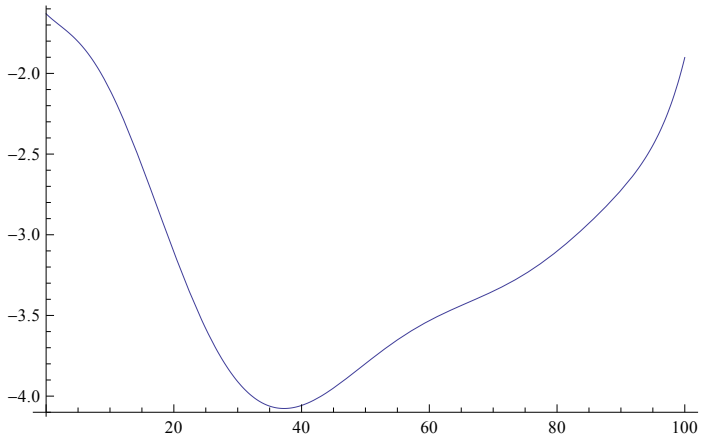
Here is the error function that we want to find a formula for. ABV Read (i.e., past tense of *to read*) is the value that you read on the alcoholometer, Temperature is the temperature of the liquid, and ABV error is what you need to add to the ABV Read value. Notice that at higher temperatures the value is negative. Along the 20 degrees C Temperature line, the error is zero.



Now, when you manipulate the graph, you see that when you look along thelines sloping from the ABV Read axis (up to the top left), they are pretty much straight lines. That means that you can treat them as “teeter-totters” rotating about the 20 degrees C horizontal line.



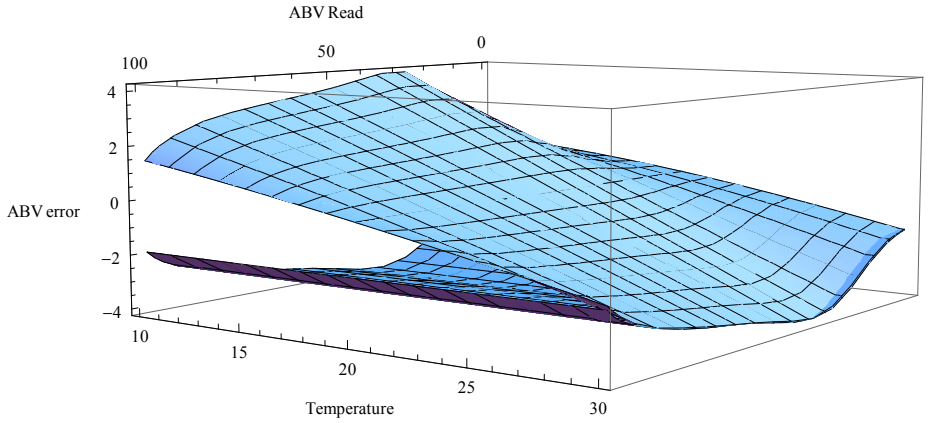
So, if we find the curve-fitting equation for 30 degrees C, it looks like this:



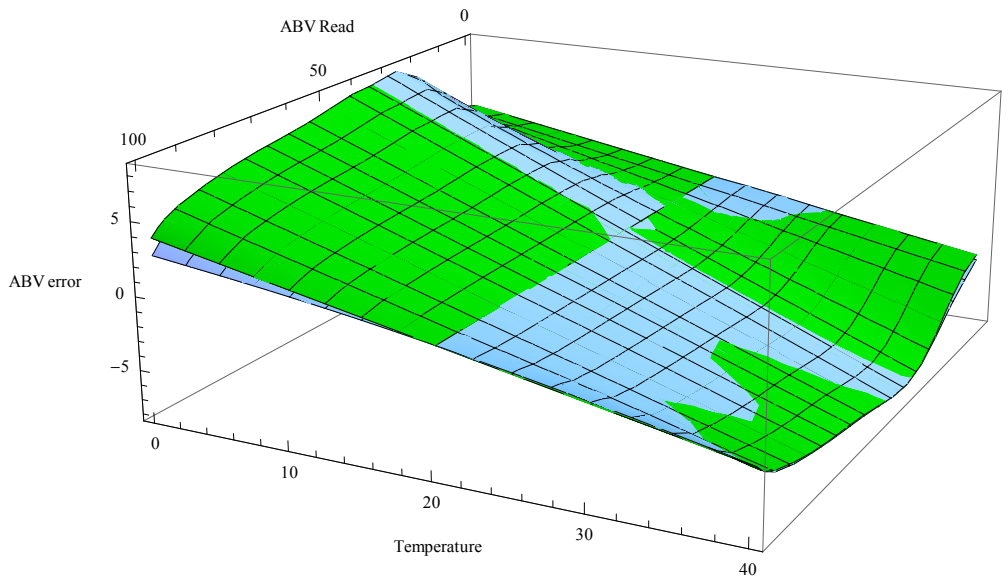
And its equation is (x is the %ABV)
error(x) =

$$-1.63048 - 0.0389141\,x + 0.00404832\,x^2 - 0.000819167\,x^3 + 0.0000414881\,x^4 - 9.51242\times10^{-7}\,x^5 + 1.13341\times10^{-8}\,x^6 - 6.86425\times10^{-11}\,x^7 + 1.67609\times10^{-13}\,x^8$$

Here is the 30 degrees C equation plotted along with the error curve:



Now, adding the “teeter-totter” term which takes the 30 degree curve and passes it through the 20 degree C line, gives this surface, shown in green. It matches the accurate error surface quite nicely, and in fact, extends from 0 to 40 degrees with not much extra error.



Here is the final equation, shown in normal algebraic form. You can add the necessary multiplication symbols. (It goes screwy if I try to put them in myself. I'm writing in a *Mathematica* notebook.)

error =

$$\frac{1}{10}\left(-1.63048 - 0.0389141\ abv + 0.00404832\ abv^2 - 0.000819167\ abv^3 + 0.0000414881\ abv^4 - 9.51242\times10^{-7}\ abv^5 + 1.13341\times10^{-8}\ abv^6 - 6.86425\times10^{-11}\ abv^7 + 1.67609\times10^{-13}\ abv^8\right)(-20+t)$$

And to 17 significant digits:

error(abv)=

$$0.10000000000000000\left(-1.6304753629830564 - 0.038914111319802963\ abv + 0.0040483204604352284\ abv^2 - 0.00081916721917430922\ abv^3 + 0.00004148811484848317922\ abv^4 - 9.5124210012948458\times10^{-7}\ abv^5 + 1.1334070909235566\times10^{-8}\ abv^6 - 6.8642471819300082\times10^{-11}\ abv^7 + 1.6760901130248503\times10^{-13}\ abv^8\right)(-20.000000000000000+t)$$

Here is a table of the errors in the error table:

	0°C	10	20	30	40
0%ABV	-2.197	-0.6535	0	-0.02330	-0.3622
20	0.7205	0.1566	0	-0.09240	-0.2197
40	-0.2624	-0.08623	0	0.03598	0.02641
60	-0.3878	-0.1292	0	-0.0009890	-0.09012
80	-0.4901	-0.1738	0	0.03872	-0.06229
100	-1.166	-0.4356	0	0.1321	0.003096

The errors are of %ABV. For example, at 10 degrees C at 60%ABV, the error of the error generated by the formula is -0.1292 %ABV.