Using an Excel Spreadsheet to Calculate K_A from pH and Initial Concentration

Since $K_A = \frac{[H^+]^2}{I - [H^+]}$, *where* $I = acid's\ initial\ concentration$,

We obtain $[H^+]^2 = K(I-[H^+])$.

Let $x = [H^+]$

$x^2 = K(I - x)$
$x^2 + Kx - KI = 0$
so for $ax^2 + bx + c = 0$,

$a = 1$
$b = K$
$c = -KI$

Substituting these values in to the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ we obtain:

$$[H^+] = \frac{-K \pm \sqrt{K^2 + 4KI}}{2}$$

So if you enter the values for initial concentration and K_A's for various acids into columns of a spreadsheet Excel can, in a new column, calculate the H^+ from:

=(-K1+SQRT(K1^2+4* I1*K1))/2

(We entered *K* and *I* into columns *K* and *I* to reduce confusion)

Notice that you do not have to worry about the (-) part of the $\pm$, since the negative value is meaningless in this context.

Then pH can be calculated in a fourth column using:

=-log(L)

This is assuming that H^+ was calculated in column L.