Solutions to the Practice Problems on Required Mathematical Skills

1. Simplify each of the following expressions as much as possible:

   (a) $-p\text{H}$

   (b) $\log_{10}(10x^2) = \log_{10} 10 + \log_{10} x^2 = 1 + 2\log_{10} x$

   (c) x

   (d) $\dfrac{(x+1)^2}{x^2+1}$ doesn't simplify.

2. Solve the following equations for x:

   (a) Rewrite this equation to the form $13x^2 + 2x - 44 = 0$. This is now a quadratic equation with solutions

   $$x = \frac{-2 \pm \sqrt{2^2 - 4(13)(-44)}}{2(13)} = \frac{-2 \pm \sqrt{2292}}{26}.$$

   If you run these numbers through your calculator, you get $x = 1.7644$ or $x = -1.9183$. Note that you should try to report answers to a reasonable number of digits and that your results must be rounded correctly. Also, if you have a quadratic equation solver programmed into your calculator, you are more than welcome to use it on a test. Just tell me that you did so I know where your numbers are coming from. The same thing goes for any other type of equation you may have to solve.

   (b) Rewrite this to the form $-13.2 = \log_{10} x$. Now take $10^{-13.2} = 10^{\log_{10} x} = x$. Therefore $x = 6.3096 \times 10^{-14}$. Note that the calculator notation (`6.3095E-14`) is *unacceptable*.

   (c) Take a natural logarithm of both sides: $\ln 13.2 = \ln e^{x^2} = x^2$. The answer falls out immediately: $x = \sqrt{\ln 13.2} = 1.6063$.

   (d) Cross-multiply and rearrange:

   $$\begin{aligned} 4.3(x+1) &= x. \\ \therefore 3.3x &= -4.3. \\ \therefore x &= -1.3030. \end{aligned}$$

(e) Again, start by cross-multiplying and rearranging:

$$
\begin{aligned}
a(x + c) &= 2x^2 + b. \\
\therefore 2x^2 - ax + b - ac &= 0. \\
\therefore x &= \frac{a \pm \sqrt{a^2 - 4(2)(b - ac)}}{2(2)} \\
&= \frac{1}{4}\left(a \pm \sqrt{a^2 - 8(b - ac)}\right).
\end{aligned}
$$