1. The length of a rectangle is $1$ inch more than the width and the area is $30$ in$^2$. Find the dimensions of the rectangle.

   *Answer.* Let $l$ be the length of the rectangle, and $w$ the width. The first part tells us that $w = l - 1$. The second tells us that $wl = 30$. Substituting gives $(l - 1)l = 30$, and so we have

   $$l^2 - l = 30 \rightarrow l^2 - l - 30 = 0.$$

   Factoring gives $(l - 6)(l + 5) = 0$, so $l = 6, -5$. We cannot have a negative length, so the length equals $6$ inches. Plugging this back in gives us that the width is $5$ inches. $\square$

2. Solve for $x$. Be sure to simplify completely.

   a) $x^2 + 2x + 5 = 0$

   b) $x^4 = 16$

   *Answer.* a) Factoring won't work, so we have to use the quadratic formula. We get

   $$\begin{aligned}
   x &= \frac{-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot 5}}{2} = \frac{-2 \pm \sqrt{4 - 20}}{2} \\
   &= \frac{-2 \pm \sqrt{-16}}{2} \\
   &= \frac{-2 \pm \sqrt{16}i}{2} \\
   &= \frac{-2 \pm 4i}{2} \\
   &= -1 + 2i, -1 - 2i.
   \end{aligned}$$

b) First, $x^4 - 16 = 0$ is a difference of squares, leading to
$$(x^2 - 4)(x^2 + 4) = 0.$$

The first term is also a difference of squares, so we get
$$(x + 2)(x - 2)(x^2 + 4) = 0.$$

Now we get that either $x + 2 = 0, x - 2 = 0, x^2 + 4 = 0$. So to start, we get that $x = 2, -2$. To deal with the last term, we can use the quadratic formula on $x^2 + 4 = 0$ to end up with $x = \pm 2i$. So in the end, we get $x = 2, -2, 2i, -2i$.

$\square$