Given a quadratic in the form

$$ax^2 + bx + c$$

where $a = 1$ and no real solutions exist, the factored form of the quadratic is:

$$\left(x + \frac{b}{2} + \sqrt{c - \left(\frac{b}{2}\right)^2}\, i\right)\left(x + \frac{b}{2} - \sqrt{c - \left(\frac{b}{2}\right)^2}\, i\right)$$

When multiplied out through the distributive property, the following table is produced:

| | | | |
|---|---|---|---|
| | $x$ | $\frac{b}{2}$ | $-\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ |
| $x$ | $x^2$ | $\left(\frac{b}{2}\right)x$ | $-x\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ |
| $\frac{b}{2}$ | $\left(\frac{b}{2}\right)x$ | $\left(\frac{b}{2}\right)^2$ | $-\left(\frac{b}{2}\right)\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ |
| $\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ | $x\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ | $\left(\frac{b}{2}\right)\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ | $-\left(c - \left(\frac{b}{2}\right)^2\right)i^2$ |

The leftover imaginary terms cancel out:

| | | | |
|---|---|---|---|
| | $x$ | $\frac{b}{2}$ | $-\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ |
| $x$ | $x^2$ | $\left(\frac{b}{2}\right)x$ | $\cancel{-x\sqrt{c - \left(\frac{b}{2}\right)^2}\, i}$ |
| $\frac{b}{2}$ | $\left(\frac{b}{2}\right)x$ | $\left(\frac{b}{2}\right)^2$ | $\cancel{-\left(\frac{b}{2}\right)\sqrt{c - \left(\frac{b}{2}\right)^2}\, i}$ |
| $\sqrt{c - \left(\frac{b}{2}\right)^2}\, i$ | $\cancel{x\sqrt{c - \left(\frac{b}{2}\right)^2}\, i}$ | $\cancel{\left(\frac{b}{2}\right)\sqrt{c - \left(\frac{b}{2}\right)^2}\, i}$ | $-\left(c - \left(\frac{b}{2}\right)^2\right)i^2$ |

Leaving the following:

$$x^2 + 2\left(\frac{b}{2}\right)x + \left(\frac{b}{2}\right)^2 - \left(c - \left(\frac{b}{2}\right)^2\right)i^2$$

$-\left(c - \left(\frac{b}{2}\right)^2\right)i^2$ simplifies to $(-1)(-1)\left(c - \left(\frac{b}{2}\right)^2\right)$, or $c - \left(\frac{b}{2}\right)^2$, which gets us the following:

$$x^2 + \cancel{2}\left(\frac{b}{\cancel{2}}\right)x + \xcancel{\left(\frac{b}{2}\right)^2} + c - \xcancel{\left(\frac{b}{2}\right)^2}$$

or:

$$x^2 + bx + c$$