More on the given example*

$$(123)(231) = (132) \; order \; 3$$

In two line notation the permutation $(123456) * (132)$ looks like $\begin{pmatrix} 123456 \\ 312456 \end{pmatrix}$.

The inverse is $\begin{pmatrix} 312456 \\ 123456 \end{pmatrix}$, and this gives the cycle (123). To prove this we apply $(312456) * (123)$, and we see $\begin{pmatrix} 312456 \\ 123456 \end{pmatrix}$, which looks somewhat reasuring.

* http://web.mit.edu/sp.268/www/rubik.pdf