Exponent Laws

For any positive integer $n$,
$$a^n = a \cdot a \cdot \cdots \cdot a$$ \hspace{1cm} (1)

For any number $a \neq 0$,
$$a^0 = 1$$ \hspace{1cm} (2)

For any number $n \neq 0$,
$$0^n = 0$$ \hspace{1cm} (3)

For any numbers $n$ and $a \neq 0$,
$$a^{-n} = \frac{1}{a^n}$$ \hspace{1cm} (4)

For any numbers $n$ and $m$ and $a \neq 0$,
$$a^n a^m = a^{n+m}$$ \hspace{1cm} (5)

$$\frac{a^n}{a^m} = a^{n-m}$$ \hspace{1cm} (6)

$$(a^n)^m = a^{nm}$$ \hspace{1cm} (7)

For any numbers $n$ and $a, b \neq 0$,
$$(ab)^n = a^n b^n$$ \hspace{1cm} (8)

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$ \hspace{1cm} (9)

For integers $n$ and $m$ and any number $a$,
$$a^{n/m} = \sqrt[\frac{1}{m}]{a^n} = (\sqrt[\frac{1}{m}]{a})^n$$ \hspace{1cm} (10)

provided these are defined.

Factoring

To factor $x^2 + Bx + C$ over the integers:
1. Identify coefficients $B$ and $C$.
2. Find two integers $P$ and $Q$ such that
   $$PQ = C \quad \text{and} \quad P + Q = B$$
3. The factorization is
   $$x^2 + Bx + C = (x + P)(x + Q)$$

To factor $Ax^2 + Bx + C$ over the integers:
1. Identify coefficients $A, B,$ and $C$.
2. Find two integers $P$ and $Q$ such that
   $$PQ = AC \quad \text{and} \quad P + Q = B$$
3. Rewrite the original trinomial in the form
   $$Ax^2 + Px + Qx + C$$
4. The polynomial now factors by grouping.

Perfect Squares
$$A^2 + 2AB + B^2 = (A + B)^2$$

Differences of Squares
$$A^2 - B^2 = (A + B)(A - B)$$

Sums and Differences of Cubes
$$A^3 + B^3 = (A + B)(A^2 - AB + B^2)$$
$$A^3 - B^3 = (A - B)(A^2 + AB + B^2)$$