

- $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$
- $(a + b)^2 - (a - b)^2 = 4ab$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(a + b)^3 = a^3 + 3ab(a + b) + b^3$
- $(a - b)^3 = a^3 - 3ab(a - b) - b^3$
- $a^3 \pm b^3 = (a \pm b)(a^2 \pm ab + b^2)$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(x^2 + y^2)(x^4 - x^2y^2 + y^4)$
- $(x^3 - y^3)(x^6 + x^3y^3 + y^6)$
- $(x - y)(x + y)(x^2 + y^2)(x^2 + xy + y^2)(x^2 - xy + y^2)(x^4 - x^2y^2 + y^4)$
- $2x^2 - 1)(2x^2 + 1)(4x^4 + 2x^2 + 1)(4x^4 - 2x^2 + 1)$
- $P(x) = a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \dots + a_1x + a_0, a_n \neq 0$

$(\sqrt{a} + \sqrt{b})$ and $(\sqrt{a} - \sqrt{b})$ are conjugate surds of each other.

The conjugate of $x + \sqrt{y}$ is $x - \sqrt{y}$.

The product of the conjugate surds $\sqrt{a} + \sqrt{b}$ and $\sqrt{a} - \sqrt{b}$,

$$(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = (\sqrt{a})^2 - (\sqrt{b})^2 = a - b,$$

is a rational quantity independent of any radical.

Similarly, the product of $a + b\sqrt{m}$ and its conjugate $a - b\sqrt{m}$ has no radical. For example,

- **Rationalizing Real Numbers of the Types** $\frac{1}{a + b\sqrt{x}}$, $\frac{1}{\sqrt{x} + \sqrt{y}}$
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