The Difference/Sum of Cubes

Formulas : $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$

$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

Examples : $x^3 - 27$

$= x^3 - 3^3$ *break down to cubes*
$= (x - 3)(x^2 + 3x + 3^2)$ *factor using formula*

$27x^3 + 8y^3$

$= 3^3 x^3 + 2^3 y^3$ *break down to cubes*
$= (3x + 2y)(3^2 x^2 - (2x)(3y) + 2^2 y^2)$ *factor using formula*
$= (3x + 2y)(9x^2 - 6xy + 4y^2)$

$x^6 - 64$

$= x^6 - 2^6$ *break down to exponents*
$= (x^2)^3 - (2^2)^3$ *break down into cubes*
$= [(x^2) - (2^2)][(x^2)^2 + (x^2)(2^2) + (2^2)^2]$ *use formula*
$= (x^2 - 2^2)(x^4 + 4x^2 + 16)$
$= (x + 2)(x - 2)(x^4 + 4x^2 + 16)$ *why?*

$8x^3 + 27y^3$

$= 2^3 x^3 + 3^3 y^3$ *break down to cubes*
$= (2x + 3y)(2^2 x^2 - (2x)(3y) + 3^2 y^2)$ *use formula*
$= (2x + 3y)(4x^2 - 6xy + 9y^2)$

$x^6 + 64$

$= x^6 + 2^6$ *break down to exponents*
$= (x^2)^3 + (2^2)^3$ *break down to cubes*
$= [(x^2) + (2^2)][(x^2)^2 - (x^2)(2^2) + (2^2)^2]$ *use formula*
$= (x^2 + 4)(x^4 - 4x^2 + 16)$

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