

Sum/Difference of Cubes Notes

Factor each completely.

$$1) x^3 + 8 \rightarrow (x)^3 + (2)^3$$

$$= (x+2)(x^2 - 2x + 4)$$

$$2) 27x^3 + 64 \rightarrow (3x)^3 + (4)^3$$

$$= (3x+4)(9x^2 - 12x + 16)$$

$$3) 1 - 64u^3 \rightarrow (1)^3 - (4u)^3$$

$$= (1-4u)(1+4u+16u^2)$$

$$4) x^3 - 8 \rightarrow (x)^3 - (2)^3$$

$$= (x-2)(x^2 + 2x + 4)$$

$$5) 4 + 500x^3 \rightarrow \text{GCF: } 4$$

$$4(1 + 125x^3)$$

$$= 4(1+5x)(1-5x+25x^2)$$

$$6) 81x^3 - 192 \rightarrow \text{GCF: } 3$$

$$3(27x^3 - 64)$$

$$= 3(3x-4)(9x^2 + 12x + 16)$$

$$7) 27u^3 + 64v^3 \rightarrow (3u)^3 + (4v)^3$$

$$= (3u+4v)(9u^2 - 12uv + 16v^2)$$

$$8) 216m^3 - n^3 \rightarrow (6m)^3 - (n)^3$$

$$= (6m-n)(36m^2 + 6mn + n^2)$$

SM2 Honors Sum and Difference of Perfect Cubes

The following are general examples of sum of perfect cubes $a^3 + b^3$ and the difference of perfect cubes $a^3 - b^3$.

- The sum or difference of perfect cubes will always factor to a binomial multiplied by a trinomial.
- The signs in those factors have a pattern and are determined by the sign in the original expression.
- If the expression is the SUM of perfect cubes $a^3 + b^3$, then the pattern is +, -, +
 $(+)(-+)$ $\rightarrow a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
- If the expression is the DIFFERENCE of perfect cubes $a^3 - b^3$, then the pattern is -, +, +
 $(-)(++)$ $\rightarrow a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
- The terms that fill in the binomial and trinomial also have a pattern. The pattern is the same for both sum and difference of perfect cubes and is as follows.
 $(a \pm b)(a^2 \pm ab + b^2)$

To find "a" cube root a^3 and to find "b" cube root b^3

EXAMPLES

$X^3 + 8$

$Y^3 - 27$

$8r^3 + 64$

$125t^3 - 1$

1. Determine the signs in both the binomial and trinomial

$(+)(-+)$ $(-)(++)$ $(+)(-+)$ $(-)(++)$

2. Now use the pattern to find the terms that fill in each blank part of the binomial and trinomial.

$(X+2)(x^2 - 2x + 4)$ $(y-3)(y^2 + 3y + 9)$ $(2r+4)(4r^2 - 8r + 16)$ $(5t-1)(25t^2 + 5t + 1)$