Chapter 8: Factoring Polynomials

SECTION 8.4: SUMS AND DIFFERENCES OF CUBES

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Perfect Cubes

- Have a factor that can be used three times to result in value of expression
- x^3
- $8y^3$
- $125w^3$

Difference of Cubes

- x^3-64
- Cube root of each term in binomial
- Use subtraction operation
- $(x-4)$
- Multiply by
  - trinomial that starts with square of first term in binomial
  - Add product of binomial terms
  - Add square of second term in binomial
- $(x-4)(x^2+4x+16)$

Sum of Cubes

- $64x^3+27$
- Cube root of each term in binomial
- Use addition operation
- $(4x+3)$
- Multiply by
  - trinomial that starts with square of first term in binomial
  - subtract product of binomial terms
  - Add square of second term in binomial
- $(4x+3)(16x^2-12x+9)$

Note:!

- You cannot factor sum of squares!
- Can factor difference of squares
  - $x^2 - C^2 = (x - C)(x + C)$
- Can factor difference of cubes
  - $x^3 - C^3 = (x - C)(x^2 + Cx + C^2)$
- Can factor sum of cubes
  - $x^3 + C^3 = (x + C)(x^2 - Cx + C^2)$
- Note single subtraction sign and that the binomial ‘matches’ the original cubic expression

Difference of Cubes in higher orders: $x^6 - y^6$

- Each term in binomial is perfect square
  - $x^6 = (x^3)^2$, right?
- So binomial is difference of two squares!!
  - $(x^3)^2 - (y^3)^2 = (x^3 - y^3) - (x^3 + y^3)$
- The follow factoring cube rules to get
  - $(x-y)(x^2+xy+y^2)\ (x+y)(x^2-xy+y^2)$

Sum of Cubes in higher order

- $x^6+y^6=(x^2)^3+(y^2)^3$
- $=(x^2)^3+(y^2)^3 = (x^2+y^2)(x^4-x^2y^2+y^4)$
- These factors are prime
  - Cannot factor sum of squares!!

Remember to factor out GFC!!

- $50x^2y^2-8y^4=$
- $2y^2(25x^2-4y^2)$
- Notice second factor is difference of two squares
- $=2y^2(5x-2y)(5x+2y)$

Suggestions for success

- Look for GFC
- Notice if there is a difference of two squares: follow method
- Notice if there is a sum or difference of two cubes: follow method
- Try factor by grouping
- Use trial and error if patterns aren't present
- Always factor COMPLETELY!!