Special Factoring

Objectives: To factor the difference of two squares, to factor Perfect Square Trinomials, and to factor the sum or difference of two cubes.

Review of GCF & Grouping
- Define factoring.
- How do we check our answer after factoring?
- Factor:
  - A) \(k^2 - 11kh + 28h^2\)
  - B) \(4x^2 + 2x - 6\)

Review
- Multiply using FOIL: \((x - 3)(x + 3)\).
  - \(x^2 + 3x - 3x - 9\)
  - Answer: \(x^2 - 9\)
  - Remember: the outside/inside terms cancel b/c they are opposite terms.
- Multiply: \((y + 2)(y - 2)\)
  - Answer: \(y^2 - 4\)
  - This answer is a special case called the DIFFERENCE OF TWO SQUARES (a.k.a. DOTS).

Factoring the Difference of Two Squares (DOTS)
- Clue 1: usually only 2 terms
- Clue 2: ________ sign
- Clue 3: ________ terms are perfect squares
- General Form: \(x^2 - y^2 = (x + y)(x - y)\)
- MEMORIZE THESE PERFECT SQUARES:
  - 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 400, 625, 900, 1000

Examples – Factor.
- a) \(x^2 - 25\)
- b) \(3a^2 - 48\)
- c) \(169x^2 - y^2\)
- d) \(81a^2 - 121b^2\)
- e) \(9x^2 - z^4\)
- f) \(4a^4 - 49b^8\)
- g) \(5y^3 - 320y\)
- h) \((m - 2)^2 - 100\)
REVIEW
The Square of a Binomial
- Multiply \((m - 4)^2\).
- Multiply \((5n + 3)^2\).

What to look for…
\[Ax^2 + Bx + C\]
- Clue 1: \(A\) & \(C\) are perfect squares.
- Clue 2: \(B\) is the square root of \(A\) times the square root of \(C\), doubled.

If these two things are true, the trinomial is a Perfect Square Trinomial (PST) and can be factored as \((x + y)^2\) or \((x - y)^2\).

General Form of Perfect Square Trinomials
\[x^2 + 2xy + y^2 = (x + y)^2\]
or
\[x^2 - 2xy + y^2 = (x - y)^2\]
- Note: When factoring, the sign in the binomial is the same as the sign of \(B\) in the trinomial.

Just watch and think.
- Ex) \(x^2 + 12x + 36\)
  - What's the square root of \(A\)? of \(C\)?
  - Multiply these and double. Does it = \(B\)?
  - Then it's a Perfect Square Trinomial!
  - Solution: \((x + 6)^2\)

- Ex) \(16a^2 - 56a + 49\)
  - Square root of \(A\)? of \(C\)?
  - Multiply and double...
  - \(= B\)?
  - Solution: \((4a - 7)^2\)

Examples
- A) \(x^2 + 8x + 16\)
- B) \(9n^2 + 48n + 64\)
- C) \(4z^2 - 36z + 81\)
- D) \(25c^2 - 20c + 4 - d^2\)
- E) \(9a^2 - 24a + 16 - b^2\)

Think, pair, share…
What if the leading term has an odd power?
- The problem could be the sum or difference of two cubes.

Factoring the Difference or Sum of Two Cubes
- Clue 1: usually only 2 terms
- Clue 2: both terms are perfect cubes

MEMORIZE THESE PERFECT CUBES:
1, 8, 27, 64, 125, 216,...1000

General Form of Factoring Cubes
\[ x^3 - y^3 = (x - y)(x^2 + xy + y^2) \]

or
\[ x^3 + y^3 = (x + y)(x^2 - xy + y^2) \]

Examples
- A) \( x^3 + 64 \)
- B) \( 8n^3 - 27 \)
- C) \( 125a^3 + b^3 \)

Think, pair, share...
- D) \( 216c^3d^3 + 1 \)
- E) \( 4y^3 - 500z^3 \)