

Factoring

Objective: To factor any polynomial!

① Great Common Factor: GCF (leftovers)

$$6x^2y^2 - 2xy^2 + 6x^3y$$

$$2 \cdot \textcircled{3}x \otimes y \textcircled{y} \ominus 2 \cdot \textcircled{2}x \cdot y \textcircled{y} \oplus 2 \cdot \textcircled{3}x \otimes \otimes y$$

$$\text{GCF} = 2xy$$

$$2xy \left(\frac{3xy - y + 3x^2}{2xy} \right)$$

Count Terms

2 terms : **Difference** of Perfect Square

$$\textcircled{2} \quad a^2 - b^2 = (a + b)(a - b) \quad *$$
$$9x^2 - 64y^2 = (3x + 8y)(3x - 8y)$$

: Sum of Perfect Cubes

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2) \quad *$$

~~Now~~ : Difference of Perfect Cubes

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2) \quad *$$

$1^2 = 1$

$17^2 = 289$

$1^3 = 1$

$\times 3$

$2^2 = 4$

$18^2 = 324$

$2^3 = 8$

$\times 6$

$3^2 = 9$

$19^2 = 361$

$3^3 = 27$

$\times 9$

$4^2 = 16$

$20^2 = 400$

$4^3 = 64$

$\times 9$

$5^2 = 25$

$\times 3$

$5^3 = 125$

$\times 9$

$6^2 = 36$

$\times 3$

$6^3 = 216$

$7^2 = 49$

$7^3 = 343$

$8^2 = 64$

$\times 4$

$8^3 = 512$

$9^2 = 81$

$9^3 = 729$

$10^2 = 100$

$10^3 = 1000$

$11^2 = 121$

$12^2 = 144$

$13^2 = 169$

$14^2 = 196$

$15^2 = 225$

$16^2 = 256$

$$\cdot 3 \cdot 3 \quad \cdot x \cdot x \quad \cdot 5 \cdot 5 \quad (a^2 + b^2) \Rightarrow \text{diff}$$

$$27x^3 - 125 = (3x - 5)(9x^2 + 15x + 25)$$

$$a = 3x \quad b = 5$$

$$(3x)^2 \quad (5)^2$$

never!

$$(a+b)(a^2 - ab + b^2) \Rightarrow \text{sum}$$

$$aaa-bbb + 444$$

$$a^3 b^3 + 64 =$$

$$(ab + 4)(a^2 b^2 - 4ab + 16)$$

$$\text{"a" = } ab \quad \text{"b" = } 4$$

$$(ab)^2 \quad 4^2 =$$

$$x^2 + 5x + 2 \cdot 3$$

Three Terms $x^2 + 5x + 6 = (x+2)(x+3)$

⑤ $x^2 - 7x + 12 = (x-3)(x-4)$

	x	-4
x	x^2	$-4x$
-3	$-3x$	$+12$

⑥ $x^2 - 1x - 6 = (x+2)(x-3)$

-1×6
 1×-6
 $2x-3$
 -2×3

Busting Up

Four or More Terms: Factor by Grouping

$$\textcircled{1} \quad x^3 + 5x^2 - 2x - 10$$

G-C-F

$$\underline{x} \underline{x} \underline{x} + \underline{5} \underline{x} \underline{x} - \underline{2} \underline{x} - \underline{2} \cdot \underline{5}$$

GCF

GCF

3 times

$$x^2(x+5) - 2(x+5)$$

GCF

$$(x+5)(x^2-2)$$

Busting Up !

⑧

$$3y^2 - 5y - 5$$

Diagram showing the decomposition of the middle term $-5y$ into $-5y + 3y$. The coefficient -5 is split into -5 and 3 , with arrows pointing to the terms in the binomial expansion below.

$$3y^2 - 5y + 3y - 5$$

$$3yy - 5y \dots$$

$$y(3y-5) + 1(3y-5)$$

$$(3y-5)(y+1)$$

① must $a \cdot c$

② Need 2 numbers that must. = ac and add = b

③ Use 2 numbers to bust up middle term

④ Four terms - factor by grouping GCF 3 times

9

$$5x^2 - 13x + 6$$

→ -10, -3

$$5x^2 - 10x - 3x + 6$$

$$5x \cdot x - 2 \cdot 5x \quad ; \quad -3x + 2 \cdot 3$$

$$5x(x-2) - 3(x-2)$$

$$(x-2)(5x-3)$$

Factor COMPLETELY!

$$\textcircled{10} \quad 64x^6 - y^6 =$$

$$(8x^3 + y^3)(8x^3 - y^3)$$

$$(2x + y)(4x^2 - 2xy + y^2)(2x - y)(4x^2 + 2xy + y^2)$$

$$\overline{2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x} - \overline{y \cdot y \cdot y}$$

$$a = 2x \quad b = y$$

$$(a + b)(a^2 - ab + b^2)$$

sum of
cubes

$$(a - b)(a^2 + ab + b^2)$$

diff of
cubes

iii

$$12n^2 - 22n - 4 =$$

$$2(n-2)(n+1)$$

$$2(6n^2 - 11n - 2)$$

$$-12$$

-12, 1

$$6n^2 - 12n + 1n - 2$$

$$6n(n-2) + 1(n-2)$$

$$(n-2)(6n+1)$$

$$(n-2)(6n+1)$$

WS S-4

add

$$(1-19)$$

2. 3. 10 - 2. 2. 5

