

6.4 Part 1 FACTORING POLYNOMIALS

I. Sum and Difference of Two Cubes:

- a) is a binomial,
- b) each term is perfect cube, and
- c) terms are connected by addition or subtraction.

Perfect Cubes:

$1 = (1)^3$	$216 = (6)^3$	$x^3 = (x)^3$	$8x^6 = (2x^2)^3$
$8 = (2)^3$	$343 = (7)^3$	$x^6 = (x^2)^3$	$216x^{15} = (6x^5)^3$
$27 = (3)^3$	$512 = (8)^3$	$x^9 = (x^3)^3$	$64x^9 = (4x^3)^3$
$64 = (4)^3$	$729 = (9)^3$	$x^{12} = (x^4)^3$	
$125 = (5)^3$	$1000 = (10)^3$	$x^{15} = (x^5)^3$	

add.

FACTOR PATTERNS

SUM OF 2 CUBES:

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

subt.

DIFFERENCE OF 2 CUBES:

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

Examples:

1. $x^3 \ominus 1000$

$$\begin{array}{cc} (x)^3 & (10)^3 \\ \text{"a"} & \text{"b"} \end{array}$$

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

$$(x - 10)(x^2 + x \cdot 10 + 10^2)$$

$$(x - 10)(x^2 + 10x + 100)$$

sum

2. $8d^3 \oplus 1$

$$\begin{array}{cc} (2d)^3 & (1)^3 \\ \text{"a"} & \text{"b"} \end{array}$$

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

$$(2d + 1)((2d)^2 - 2d \cdot 1 + 1^2)$$

$$(2d + 1)(4d^2 - 2d + 1)$$

Examples:

3. $64y^3 - 1$ ^{diff.}

$(4y)^3 - (1)^3$
 "a" "b"

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

$$(4y-1)((4y)^2+4y\cdot 1+1^2)$$

$$(4y-1)(16y^2+4y+1)$$

5. $216m^9 + 125$ ^{sum}

$(6m^3)^3 + (5)^3$
 "a" "b"

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

$$(6m^3+5)((6m^3)^2-6m^3\cdot 5+5^2)$$

$$(6m^3+5)(36m^6-30m^3+25)$$

4. $512 + 27k^3$ ^{sum}

$(8)^3 + (3k)^3$
 "a" "b"

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

$$(8+3k)(8^2-8\cdot 3k+(3k)^2)$$

$$(8+3k)(64-24k+9k^2)$$

6. $64 - 343h^3$ ^{diff.}

$(4)^3 - (7h)^3$
 "a" "b"

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

$$(4-7h)(4^2+4\cdot 7h+(7h)^2)$$

$$(4-7h)(16+28h+49h^2)$$

II. GCF Revisited

REMEMBER!! The first step to factoring is LOOK FOR A GCF and factor out!

7. $3d^3 - 81$ $GCF = 3$

$3(d^3 - 27)$ ^{diff.}

$(d)^3 - (3)^3$
 "a" "b"

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

$$3(d-3)(d^2+d\cdot 3+3^2)$$

$$3(d-3)(d^2+3d+9)$$

9. $6w^4 + 48w$ $GCF = 6w$

$6w(w^3 + 8)$ ^{sum}

$(w)^3 + (2)^3$
 "a" "b"

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

$$6w(w+2)(w^2-w\cdot 2+2^2)$$

$$6w(w+2)(w^2-2w+4)$$

8. $54p^3 + 2$ $GCF = 2$

$2(27p^3 + 1)$ ^{sum}

$(3p)^3 + (1)^3$
 "a" "b"

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

$$2(3p+1)(3p^2-3p\cdot 1+1^2)$$

$$2(3p+1)(9p^2-3p+1)$$

10. $16x^5 - 250x^2$ $GCF = 2x^2$

$2x^2(8x^3 - 125)$

$(2x)^3 - (5)^3$
 "a" "b"

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

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

$$2x^2(2x-5)(4x^2+10x+25)$$