Your Name

Mrs. Theo

12 / 1 / 22

Notes

Complex Zeros

Perfect Square Trinomials and

Sum and Difference of Cubes

pg. 70

Perfect Square Trinomials

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

$16x^2 - 24x + 9 = (4x-3)(4x-3) = (4x-3)^2$

$\sqrt{\ }$ 1st and last terms

middle term sign

why? $16x^2 - 12x - 12x + 9$

$2(-12x)$

Difference of Cubes SOAP

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

take $\sqrt[3]{\ }$ of both terms

same sign

opposite sign

Always Positive

$x^3 - 216 = (x-6)(x^2+6x+36)$

square 1st term

multiply 1st + 2nd term

square 2nd term

$\sqrt[3]{x^3} = x^{\frac{3}{3}} = x$

$\sqrt[3]{216} = 6$

$216 \wedge (1/3) = 6$

$216^{1/3} = 6$

Sum of Cubes

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

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

gives two imag. answers

$\sqrt[3]{x^3} = x$

$\sqrt[3]{125} = 5$

why Factor?

$x^3+125=0$

$x^3 = -125$

$x = -5$

only 1 answer but supposed to be 3!

CONCEPT Polynomial Identities

A mathematical statement that equates two polynomial expressions is an **identity** if one side can be transformed into the other side using mathematical operations. These polynomial identities are helpful tools used to multiply and factor polynomials.

Difference of Squares
$a^2 - b^2 = (a + b)(a - b)$

Example: $25x^2 - 36y^2$
Substitute $5x$ for a and $6y$ for b.
$25x^2 - 36y^2 = (5x + 6y)(5x - 6y)$

Square of a Sum
$(a + b)^2 = a^2 + 2ab + b^2$

Example: $(3x + 4y)^2$
Substitute $3x$ for a and $4y$ for b.
$(3x + 4y)^2 = (3x)^2 + 2(3x)(4y) + (4y)^2$
$= 9x^2 + 24xy + 16y^2$

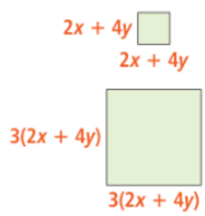
Difference of Cubes
$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Example: $8m^3 - 27$
Substitute $2m$ for a and 3 for b.
$8m^3 - 27 = (2m - 3)[(2m)^2 + (2m)(3) + 3^2]$
$= (2m - 3)(4m^2 + 6m + 9)$

Sum of Cubes
$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Example: $g^3 + 64h^3$
Substitute g for a and $4h$ for b.
$g^3 + 64h^3 = (g + 4h)[g^2 - (g)(4h) + (4h)^2]$
$= (g + 4h)(g^2 - 4gh + 16h^2)$

Audra wants to build a larger food container to feed her ducklings. The current side lengths of the base of the container are $2x + 4y$ in. She would like the sides of the base of the new food container to be triple the original lengths. What is the area of the base of the new food container?



EXAMPLE 2 Use Polynomial Identities to ~~Multiply~~ Factor

Try It!

2. Use polynomial identities to ~~multiply~~ Factor the expression:

a. $9x^4 + 30x^2y^3 + 25y^6$

$\sqrt[2]{9x^4} = 3x^{\frac{4}{2}}$
$= 3x^2$
$\sqrt[2]{25y^6} = 5y^{\frac{6}{2}}$
$5y^3$

$(3x^2 + 5y^3)(3x^2 + 5y^3)$

$\boxed{(3x^2 + 5y^3)^2}$

$\boxed{\text{Perfect Square Trinomial}}$

Check: $9x^4 + 15x^2y^3 + 15x^2y^3 + 25y^6$

b. $144x^2 - 216x + 81$

$\sqrt{144x^2} = 12x$
$\sqrt{81} = 9$

$(12x - 9)(12x - 9)$

$\boxed{(12x - 9)^2}$

EXAMPLE 3 Use Polynomial Identities to Factor and Simplify

Try It!

3. Use polynomial identities to factor each polynomial.

Difference of Squares

a. $m^8 - 9n^{10}$ $\sqrt{m^8} = m^{\frac{8}{2}} = m^4$ $\sqrt{9n^{10}} = 3n^{\frac{10}{2}} = 3n^5$

$(m^4 + 3n^5)(m^4 - 3n^5)$

Difference of Cubes

b. $27x^9 - 343y^6$ $\sqrt[3]{27x^9} = 3x^{\frac{9}{3}} = 3x^3$ $\sqrt[3]{343y^6} = 7y^{\frac{6}{3}} = 7y^2$

$(3x^3 - 7y^2)(9x^6 + 21x^3y^2 + 49y^4)$

c. $x^3 + 27$

d. $125x^3 - 64$

Sum of Cubes

Form: $x^3 + a^3$

same number

2-terms

Binomial of degree 3, addition

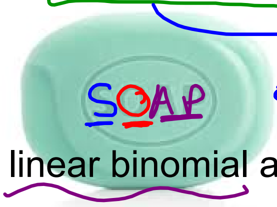
cube

Factors into this

same sign opposite sign Always positive

$$\boxed{x^3 + a^3 = (x + a)(x^2 - ax + a^2)}$$

cubic root of 1st Term cubic root of 2nd Term 1st Term squared Product of 1st and 2nd Terms 2nd Term squared



$x^3 + 8 = 0$

$\sqrt[3]{x^3} = \sqrt[3]{-8}$

$x = -2$

and 2 imag.

a linear binomial and a quadratic with 2 imaginary solutions which can be found using the quadratic formula

EXAMPLE 3 Use Polynomial Identities to Factor and Simplify

$\sqrt[3]{27} = 3 = 27^{\frac{1}{3}}$

Try It!

3. Use polynomial identities to factor each polynomial.

Difference of Squares

a. $m^8 - 9n^{10}$ $\quad \frac{8}{2} = 4 \checkmark, \ \frac{10}{2} = 5 \checkmark$

$\boxed{(m^4 + 3n^5)(m^4 - 3n^5)}$

$\sqrt{m^8} = m^4$

$\sqrt{9n^{10}} = 3n^5$

Difference of Cubes $\quad \frac{9}{3} = 3 \checkmark, \ \frac{6}{3} = 2 \checkmark$

b. $27x^9 - 343y^6$

$(3x^3 - 7y^2)(9x^6 + 21x^3y^2 + 49y^4)$

$\sqrt[3]{27x^9} = 3x^3$

$\sqrt[3]{343y^6} = 7y^2$

c. $x^3 + 27$

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

Square 1st term — multiply 1st and 2nd terms — square 2nd term

d. $125x^3 - 64$

a) $x^3 + 27$

$\sqrt[3]{27} = 3$

$(x + a)(x^2 - ax + a^2)$

$(x + 3)(x^2 - 3x + 3^2)$

$\boxed{(x + 3)(x^2 - 3x + 9)}$

b) $x^3 + 64 = 0$ $\quad \sqrt[3]{x^3} = x \quad \sqrt[3]{64} = 4$

$(x + 4)(x^2 - 4x + 16) = 0$

$(x + a)(x^2 - ax + a^2)$

$x + 4 = 0$

$x = -4$

rational solution

$x^2 - 4x + 16 = 0$ $\quad a = 1 \quad b = -4 \quad c = 16$

must use quadratic formula to solve for imaginary solutions

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(16)}}{2(1)}$

$x = \frac{4 \pm \sqrt{-48}}{2}$

$x = \frac{4}{2} + \frac{i\sqrt{48}}{2}$ & $x = \frac{4}{2} - \frac{i\sqrt{48}}{2}$

$\boxed{x = -4, \ x = 2 + 3.464i, \ \& \ x = 2 - 3.464i}$

c. $216x^3 + 1 = 0$

Factored

$(6x + 1)(36x^2 - 6x + 1) = 0$

$\ \ m + a \qquad m^2 - am + a^2$

Side Note: $\sqrt[3]{216x^3}$ and $\sqrt[3]{1}$

$m = 6x \qquad a = 1$

$\boxed{\text{Solve for } x}$

separate and set $= 0$

$6x + 1 = 0$

$6x = -1$

$x = -\frac{1}{6}$

$36x^2 - 6x + 1 = 0$

$a = 36 \quad b = -6 \quad c = 1$

$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(36)(1)}}{2(36)}$

$x = \frac{6 \pm \sqrt{-108}}{72}$ $\quad$ split into + and −

$x = \frac{6}{72} + \frac{i\sqrt{108}}{72}$ & $x = \frac{6}{72} - \frac{i\sqrt{108}}{72}$

$\boxed{x = -\frac{1}{6}, \ x = 0.083 + 0.144i, \text{ and } x = 0.083 - 0.144i}$

Difference of Cubes

Form: $x^3 - a^3$

Binomial of degree 3, subtraction

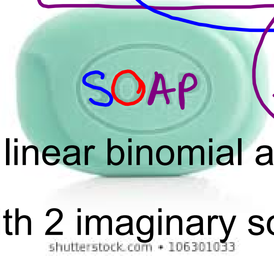
Factors into this

same sign   opposite sign   Always positive

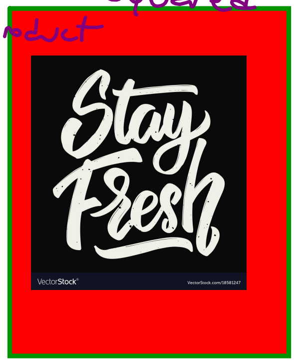
$$x^3 - a^3 = (x - a)(x^2 + ax + a^2)$$

$\sqrt[3]{x^3} = x$ $\sqrt[3]{a^3} = a$

squared   product   squared



a linear binomial and a quadratic with 2 imaginary solutions which can be found using the quadratic formula



$x^3 - 8$

S O AP

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

$\sqrt[3]{x^3} = x$

$\sqrt[3]{8} = 2$

a) $x^3 - 8$

$\sqrt[3]{x^3} = x$ $\sqrt[3]{8} = 2$

$(x-a)(x^2 - ax + a^2)$

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

$\boxed{(x-2)(x^2-2x+4)}$

b) $x^3 - 125 = 0$

$\sqrt[3]{x^3} = x$ $\sqrt[3]{125} = 5 = a$

$(x-a)(x^2+ax+a^2)$

$\boxed{(x-5)(x^2+5x+25)=0}$

$x-5=0$ $x^2+5x+25=0$

$x=5$ $x = \dfrac{-5 \pm \sqrt{5^2-4(1)(25)}}{2(1)}$

$x = \dfrac{-5 \pm \sqrt{-75}}{2}$

$x = \dfrac{-5 \pm 8.660i}{2}$

$x = \dfrac{-5}{2} \pm \dfrac{8.660}{2} i$

$\boxed{x=5 \quad x=-2.5+4.330i \quad x=-2.5-4.330i}$

Extension

c) $27x^3 - 8$

$\sqrt[3]{27x^3} = 3x$ $\sqrt[3]{8} = 2$

$(x-a)(x^2+ax+a^2)$

S O AP

$(3x-2)((3x)^2+(2)(3x)+2^2)$

$\boxed{(3x-2)(9x^2+6x+4)}$

$64x^3 = 125$

$64x^3 - 125 = 0$

Difference of cubes Factored

$(4x - 5)(16x^2 + 20x + 25) = 0$

$m - a \quad m^2 + ma + a^2$

S O AP

Solve for x

$4x - 5 = 0 \qquad 16x^2 + 20x + 25 = 0$

$4x = 5$

$\boxed{x = \frac{5}{4}}$

$x = \frac{-20 \pm \sqrt{(20)^2 - 4(16)(25)}}{2(16)}$

$x = \frac{-20 \pm \sqrt{-1200}}{32}$

$x = \frac{-20}{32} + \frac{i\sqrt{1200}}{32}$ and $x = \frac{-20}{32} - \frac{i\sqrt{1200}}{32}$

$\boxed{x = \frac{5}{4},\ x = -0.625 + 1.083i \text{ and } x = -0.625 - 1.083i}$

$0 = 216 + 8y^6$

$8y^6 + 216 = 0$

$\sqrt[3]{8y^6} = 2y^2 \qquad \sqrt[3]{216} = 6$

$(2y^2 + 6)(4y^4 - 12y^2 + 36) = 0$

$(\sqrt{2}y + \sqrt{6}i)(\sqrt{2}y - \sqrt{6}i)$

$2y^2 + 6 = 0 \qquad 4y^4 - 12y^2 + 36 = 0$

$2y^2 = -6$

$y^2 = -3$

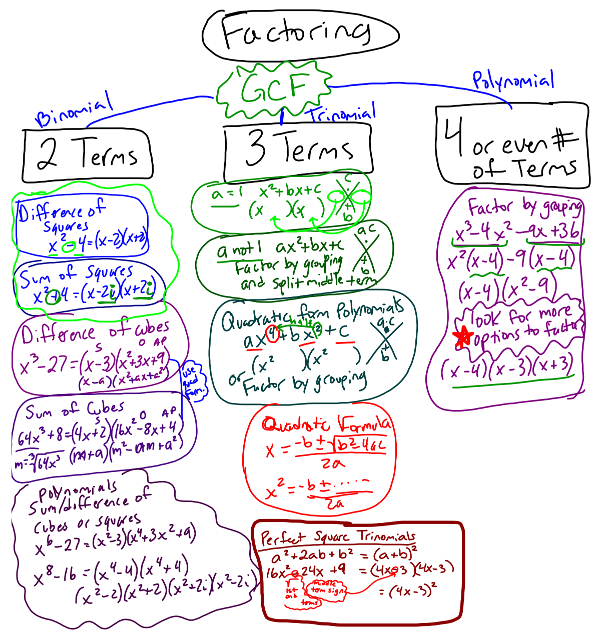
$y = \pm i\sqrt{3}$

$y^2 = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(36)}}{2(4)}$

$y^2 = \frac{12 + i\sqrt{432}}{8} \qquad y^2 = \frac{12 - i\sqrt{432}}{8}$

2 imag 2 imag

$\boxed{\text{4 imaginary solutions}}$



Factor And Solve

$27x^3 - 8$

Factor and Solve :

$64a^3 + 1$

Factor and solve:

$8y^3 - 27$

Factor And Solve

27x^3 – 8

x=-1/3 + 0.577i	x=-1/3 - 0.577i	x=2/3

Factor and Solve :

64a^3 +1

a=-1/4	a= 0.125 + 0.217i	a=0.125 - 0.217i

Factor and solve:

8y^3 - 27x°

S O AP

$(2y - 3)(4y^2 + 6y + 9)$

1st term, 2nd Term, squared, 1st · 2nd, squared

$2y - 3 = 0$ $\quad$ $4y^2 + 6y + 9 = 0$

$y = \frac{3}{2}$

$\boxed{y = 1.5}$

$y = \frac{-6 \pm \sqrt{6^2 - 4(4)(9)}}{2(4)}$

$y = \frac{-6 \pm \sqrt{-108}}{8}$

$y = \frac{-6}{8} \pm \frac{\sqrt{108}}{8} i$

$y = -0.75 \pm \frac{10.39}{8} i$

$$\boxed{\begin{aligned} y &= -0.75 + 1.299i \\ y &= -0.75 - 1.299i \end{aligned}}$$

Key

Polynomials - Factoring Sum and Differences of Two Cubes

Draw a line from the cube to its factors. The lines will go through a letter then a number. Write them at the bottom to find what happened when the students went to the Coca-Cola factory.

$8x^3-125y^3$	$(3x-4y)$	$(4x^2+6xy+9y^2)$
$27x^3-125y^3$	$(2x-5y)$	$(9x^2+12xy+16y^2)$
$27x^3-64y^3$	$(3x-5y)$	$(9x^2-12xy+16y^2)$
$27x^3-8y^3$	$(2x-3y)$	$(4x^2+10xy+25y^2)$
$8x^3-27y^3$	$(3x+4y)$	$(9x^2+15xy+25y^2)$
$27x^3+64y^3$	$(3x-2y)$	$(16x^2-20xy+25y^2)$
$8x^3+27y^3$	$(2x+3y)$	$(9x^2+6xy+4y^2)$
$64x^3+125y^3$	$(4x+5y)$	$(4x^2-10xy+25y^2)$
$27x^3+125y^3$	$(2x+5y)$	$(4x^2-6xy+9y^2)$
$8x^3+125y^3$	$(4x+3y)$	$(16x^2-12xy+9y^2)$
$64x^3+27y^3$	$(3x+5y)$	$(9x^2-15xy+25y^2)$
$64x^3-125y^3$	$(4x-5y)$	$(9x^2-6xy+4y^2)$
$27x^3+8y^3$	$(3x+2y)$	$(16x^2+20xy+25y^2)$

T	H	E	R	E	W	A	S	A	P	O	P	Q	U	I	Z
9	6	1	10	1	8	3	12	3	7	5	7	11	2	13	4

There was a pop quiz.

Key

1	$8x^3 - 125$	$(2x-5)(4x^2+10x+25)$
2	$a^3b^6 + 64$	$(ab^2+4)(a^2b^4 - 4ab^2 + 16)$
3	$27y^9 + 1$	$(3y^3+1)(9y^6 - 3y^3 + 1)$
4	$8a^3 - b^3$	$(2a-b)(4a^2+2ab+b^2)$
5	$x^6 - 8$	$(x^2-2)(x^4+2x^2+4)$
6	$b^9 + x^6$	$(b^3+x^2)(b^6 - b^3x^2 + x^4)$
7	$64a^3 - 1$	$(4a-1)(16a^2+4a+1)$
8	$8a^3b^3 - x^6$	$(2ab - x^2)(4a^2b^2 + 2abx^2 + x^4)$
9	$x^3 + 125$	$(x+5)(x^2 - 5x + 25)$
10	$27a^{12} + 1$	$(3a^4+1)(9a^8 - 3a^4 + 1)$
11	$x^{15} - 1$	$(x^5-1)(x^{10}+x^5+1)$
12	$8b^3 + x^6$	$(2b+x^2)(4b^2 - 2bx^2 + x^4)$
13	$y^6b^3 + 1$	$(y^2b+1)(y^4b^2 - y^2b + 1)$
14	$64a^9 + 125$	$(4a^3+5)(16a^6 - 20a^3 + 25)$
15	$b^3 + x^3$	$(b+x)(b^2 - bx + x^2)$
16	$8y^6 - 27$	$(2y^2-3)(4y^4+6y^2+9)$
17	$a^6b^6 - 8$	$(a^2b^2-2)(a^4b^4+2a^2b^2+4)$

Write the GridWord here: SHELL

$2ab - x^2$	$b^2 - bx + x^2$	$2x - 5$	$a + 2$	$a^4 + a^2b^2 - 2$	$b^3 - x^2$	$y^2 - 1$	$5x$	$x^{10} + x^5 + 1$	$b^3 + x^2$	$2a$	$a^4b^2 + 4ab^2 + 16$	$x - y$	$4y^4 + 6y^2 + 9$	$ab + 4$
$3a^4 + 1$	$64a^2 + 4a - 1$	$b - x$	$5x^2$	$4x^2 + 10x + 25$	$2a + b$	$27a^4 - 1$	a	$4a^2 + 2ab + b^2$	$3x^2 - 6$	3	$a^2b^2 + 8$	$b^2 + 2$	$9y^6 - 3y^3 + 1$	$x + 1$
$x^2 - 2$	$x^2 - 5x + 25$	$y^2b + 1$	$bx + 1$	$9a^8 - 3a^4 + 1$	$4a + 1$	$4a^2 - a - 1$	2	$16a^6 - 20a^3 + 25$	$4a^3 + 5$	b^4	$a^2b^4 - 4ab^2 + 16$	$4y^2 + 3$	$b^6 - b^3x^2 + x^4$	$4a - 1$
$2b - x^2$	$b^6 - bx + 2$	$x + 5$	$yb + 1$	$a^2b^2 - 2$	$2a - b$	$2y^2 - 3$	bx	$4a^2b^2 + 2abx^2 + x^4$	$b^6 + x^4$	$8x$	$a^4b^4 + 2a^2b^2 + 4$	$b - 2x$	$x^2 - 25x - 25$	$x^2 - 3$
$b + x$	$x^4 + 2x^2 + 4$	$x^5 - 1$	$4x$	$16a^2 + 4a + 1$	$x^5 + 1$	$2b + x^2$	y^6	$y^4b^2 - y^2b + 1$	$3y^2 + 1$	xy	$4b^2 - 2bx^2 + x^4$	$ab^2 + 4$	$x^{10} - x^5 + 5$	$a - 5$

-Key

3-3 Factor Sum and Difference of Cubes Homework Header:

Just factor the two below:

1. $27x^{12} + 1$ $\sqrt[3]{27x^{12}} = 3x^{12/3}$ $\sqrt[3]{1} = 1$
$\boxed{(3x^4+1)(9x^8-3x^4+1)}$

2. $8b^3 - x^6$ $\sqrt[3]{x^6} = x^{6/3} = x^2$ $\sqrt[3]{8b^3} = 2b^{3/3} = 2b$
$\boxed{(2b-x^2)(4b^2+2bx^2+x^4)}$

3) $4y^2-12y+9$ $\sqrt{4y^2} = 2y$ $\sqrt{9} = 3$
$(2y-3)^2$

4) $64y^4+16y^2+1$ $\sqrt{64y^4} = 8y^{4/2}$ $\sqrt{1} = 1$
$(8y^2+1)^2$

Factor and finish solving for x for the 3 below:

3. $x^3 + 343 = 0$ $\sqrt[3]{343} = 7$
$(x+7)(x^2+7x+49) = 0$
$x+7=0$ $\boxed{x=-7}$
$x^2+7x+49=0$
$x = \frac{-(7) \pm \sqrt{7^2-4(1)(49)}}{2(1)}$
$x = \frac{-7 \pm \sqrt{-147}}{2}$
$x = \frac{-7 \pm \sqrt{147}\,i}{2}$
$x = \frac{-7+12.124}{2}$ $x = \frac{-7-12.124}{2}$
$\boxed{x=-2.562 \quad x=-9.562}$

4. $8x^3 - 125 = 0$
$(2x-5)(4x^2+10x+25) = 0$
$2x-5=0$ $\boxed{x=\frac{5}{2}}$
$x = \frac{-10 \pm \sqrt{10^2-4(4)(25)}}{2(4)}$
$x = \frac{-10 \pm \sqrt{-300}}{8}$
$x = \frac{-10+17.321i}{8}$ $x = \frac{-10-17.321i}{8}$
$\boxed{x=-1.25 \pm 2.165i}$

5. $64x^3 - 1 = 0$
$(4x-1)(16x^2+4x+1) = 0$
$4x-1=0$ $\boxed{x=\frac{1}{4}}$
$16x^2+4x+1=0$
$x = \frac{-4 \pm \sqrt{4^2-4(16)(1)}}{2(16)}$
$x = \frac{-4 \pm \sqrt{-48}}{32}$
$x = \frac{-4 \pm 6.928i}{32}$
$\boxed{x=-0.125 \pm 0.217i}$

2

Key

Factoring Frenzy!!!

Name Key

Factor each expression as completely as you can.
You may need a separate sheet of paper to put all your work on.

Group #1 GCF

1. $8m^2 + 4am + 16my$ $\boxed{4m(2m+a+4y)}$
2. $27c^3d^2 - 18c^2d + 9bc^2d$ $\boxed{9c^2d(3cd-2+b)}$
3. $-9x - 6x^2 - x^3$ $\boxed{-x(x^2+6x+9)}$
4. $3xy^3 + 6xyz - 18zy^2x^3$ $\boxed{-3xy(6x^2yz-y^2-2z)}$
5. $b(a-4) + 5(a-4)$ $\boxed{(a-4)(b+5)}$

Group #2 Difference and Sum of 2 Squares

1. $x^2 - 81$ $\boxed{(x+9)(x-9)}$
2. $4x^2 - 9$ $\boxed{(2x+3)(2x-3)}$
3. $m^2 + 49$ $\boxed{(m+7i)(m-7i)}$
4. $16m^8 - 81n^4$ $\boxed{(4m^4+9n^2)(4m^4-9n^2)}$
5. $121y^4 + 49z^6$ $\boxed{(11y^2+7z^3i)(11y^2-7z^3i)}$

Group #3 Sum/Difference of 2 Cubes

1. $r^3 + s^3 = \boxed{(r+s)(r^2-rs+s^2)}$
2. $64z^6 - w^3 = \boxed{(4z^2-w)(16z^4+4wz^2+w^2)}$
3. $8d^3 - 27c^3 = \boxed{(2d-3c)(4d^2+6dc+9c^2)}$
4. $2y^4 + 16y = 2y(y^3+8)$
$= \boxed{2y(y+2)(y^2-2y+4)}$
5. $27 - y^{12}$
$-1(y^{12}-27) = \boxed{-(y^4-3)(y^8+3y^4+9)}$

Group #4 Trinomials

1. $x^2 + 10x + 9$ $\boxed{(x+1)(x+9)}$
2. $12x^2 - 16x + 5$ $\boxed{(2x-1)(6x-5)}$
3. $4n^2 + 2n - 6$ $2(2n^2+n-3)$ $\boxed{2(2x+3)(x-1)}$
4. $16y^2 + 17y - 14$ $y = \frac{-17 \pm \sqrt{17^2-4(16)(-14)}}{2(16)}$ $y=0.544$ $y=-1.607$
$\boxed{16(y-0.544)(y+1.607)}$
5. $5t^4 - 25t^2 + 20$ $5(t^4-5t^2+4)$
$\boxed{5(t^2-4)(t^2-1)}$

Group #5 Grouping

1. $x^2 + 6x + 9 - 36y^2$
Not factorable by grouping
2. $r^2 - 4r - rp + 4p$ $\boxed{(r-4)(r-p)}$
3. $35ac - 3bd - 7ad + 15bc$ $(5c-d)(7a+3b)$
$35ac - 7ad + 15bc - 3bd$
4. $a^2x - b^2x + a^2y - b^2y$ $(a^2-b^2)(x+y)$
5. $t^3 + 125 + 5t^2 + 25t$
$t^3+5t^2+25t+125$
$(t+5)(t^2+25)$

Group #6 Perfect Square Trinomials

1. $m^2 - 10x + 25$ $(m-5)(m-5)$ $\boxed{(m-5)^2}$
2. $x^2 + x + ¼$ $\boxed{(x+\frac{1}{2})^2}$
3. $25x^2 - 10x + 1$ $\boxed{(5x-1)^2}$
4. $x^2 + 12x + 36$ $\boxed{(x+6)^2}$
5. $49x^2 - 56x + 16$ $\boxed{(7x-4)^2}$

Key

Group #7 Mix – Up Factor and Solve

1. $18x^3 + 8x = 0$

$2x(9x^2+4)=0$

$2x(3x+2i)(3x-2i)=0$

$x=0 \quad x=\frac{-2i}{3} \quad x=\frac{2}{3}i$

2. $6x^4 = 12x^3 - 3x^2$

$6x^4-12x^3+3x^2=0$

$3x^2(2x^2-4x+1)=0$

$3x^2=0 \quad 2x^2-4x+1=0$

$\boxed{x=0 \text{ twice}}$ $x=\frac{-(-4)\pm\sqrt{(-4)^2-4(2)(1)}}{2(2)}$ $x=\frac{4\pm\sqrt{8}}{4}$

$\boxed{x=1.707 \quad x=0.293}$

3. $5h^3 - 10h^2 + h = 2$

$5h^3-10h^2+h-2=0$

$(h-2)(5h^2+1)=0$

$h-2=0 \quad 5h^2+1=0$

$h=2 \quad h=\pm\sqrt{\frac{1}{5}}\,i$

4. $27m^3 + 64 = 0$

$(3m+4)(9m^2-12m+16)=0$

$3m+4=0 \quad \boxed{m=\frac{-4}{3}}$

$9m^2-12m+16=0$

$m=\frac{-(-12)\pm\sqrt{(-12)^2-4(9)(16)}}{2(9)}$

$m=\frac{12\pm\sqrt{-432}}{18}$

$m=\frac{12+20.785i}{18}$

$\boxed{m=0.67\pm1.155i}$

5. $p^8 - 32p^4 + 256 = 0$ (factor it 3 times! 4 imag. ans)

$(p^4-16)(p^4-16)=0$

$(p^2+4)(p^2-4)\ (p^2+4)(p^2-4)=0$

$(p+2i)(p-2i)(p+2)(p-2)(p+2i)(p-2i)(p+2)(p-2)=0$

$\boxed{p=2i \text{ twice} \quad p=-2i \text{ twice} \quad p=-2 \text{ twice} \quad p=2 \text{ twice}}$

Last 2 questions to help lead into our next topic!

1. What are the zeros/roots/solutions to this **cubic** polynomial?

3 total

1A. Real Solutions are: $x=-2$ twice, $x=1$

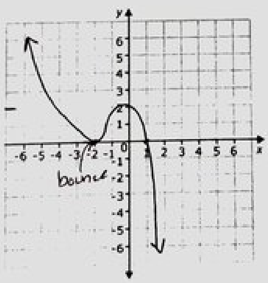
1B. # of Imaginary solutions are: 0

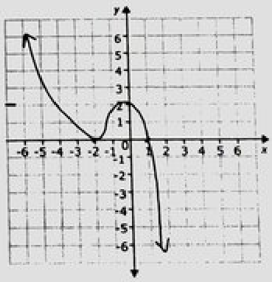
2. What are the zeros/roots/solutions to this **7th degree** polynomial?

7 total

2A. Real Sols: $x=-2$ twice, $x=1$

2B. # of Imaginary solutions are: 4





***What is happening at x = -2? Because it bounces there, it is a solution twice.

It would factor to: $f(x) = (x-1)(x+2)^2$