Name:

Advanced Algebra

Unit 5: Polynomials: Assignment #11

Factoring higher level polynomials:

For the following problems factor out the Prompt: Greatest Common Factor

1) $14x^2 + 8x + 72$

$2(7x^2+4x+36)$

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

$3x^3(x-4)$

3) $-35x^3+28x^2+7x$

$7x(-5x^2+4x+1)$

4) $24x^4-6x$

$6x(4x^3-1)$

5) $39x^5+13x^3-78x^2$

$13x^2(3x^3+1x-6)$

6) $145x^9-29$

$29(5x^9-1)$

7) $6x^6 - 3x^4 - 9x^2$

$3x^2(2x^4-x^2-3)$

8) $72x^9 + 15x^6 + 9x^3$

$3x^3(24x^6+5x^3+3)$

I can recognize Special patterns :

Name of Pattern	Example
Sum and Difference: $(a+b)(a-b) = a^2-b^2$	$(x+3)(x-3)= x^2-9$
Square of a Binomial: $(a+b)2 = a^2 + 2ab+b^2$ $(a-b)2 = a^2 - 2ab + b^2$	$(y+4)^2= y^2+8y+16$ $(3t^2-2)^2= 9t^4-12t^2+4$
Cube of a binomial: $(a+b)^3 = a^3+3a^2b+3ab^2+b^3$ $(a-b)^3 = a^3-3a^2b+3ab^2-b^3$	$(x+1)^3= x^3 +3x^2+3x+1$ $(p-2)^3 = p^3-6p^2+12p-8$
Sum of two Cubes: $a^3 +b^3 = (a+b)(a^2-ab+b^2)$	$X^3+8 = (x+2)(x^2-2x+4)$
Difference of two Cubes: $a^3-b^3= (a-b)(a^2+ab+b^2)$	$8x^3 - 1 = (2x-1)(4x^2+2x + 1)$

* Key point IS
① Do both Terms have A cube Root?
② If "yes" find the cube Root of each
③ follow "minus" pattern "plus" pattern

Classwork: **Prompt: Use the Sum or Difference of Cubes to factor the polynomial. The state the Root(s)**

Sum of two Cubes: $a^3+b^3 = (a+b)(a^2-ab+b^2)$	$X^3+8 = (x+2)(x^2-2x+4)$
Difference of two Cubes: $a^3-b^3= (a-b)(a^2+ab+b^2)$	$8x^3-1 = (2x-1)(4x^2+2x+1)$

1) x^3-8
x is "like a" 2 is "like b" Follow Difference Pattern
$(x-2)(x^2+2x+14)$
Root(s) 2

2) x^3+64
Follow the Sum Pattern
$(x+4)(x^2-4x+16)$
Root(s) -4

3) $216x^3+1$
Follow Sum pattern
$(6x+1)(36x^2-6x+1)$
Root(s) $-\frac{1}{6}$

4) $125x^3-8$
Follow Minus Pattern
$(5x-2)(25x^2+10x+4)$
Root(s) $\frac{2}{5}$

5) $1000x^3+27$
Follow Sum Pattern
$(10x+3)(100x^2-30x+9)$
Root(s) $-\frac{3}{10}$

6) $27x^3+216$
Follow Sum Pattern
$(3x+6)(9x^2-18x+36)$
Root(s) -2

7) $32x^3-4$
$4(8x^3-1)$
Follow minus pattern
$4(2x-1)(4x^2+2x+1)$
Root(s) $\frac{1}{2}$

8) $2x^3+54$
$2(x^3+27)$
$2(x+3)(x^2-3x+9)$
Root(s) -3

Prompt: Grouping: Factor the following by grouping. Then state the root(s)

1) $x^3 + x^2 + x + 1$

$(x^3 + x^2) + (x+1)$

$x^2(x+1) + (x+1)$

$(x+1)(x^2+1)$

Root(s) -1

2) $10x^3 + 20x^2 + x + 2$

$(10x^3 + 20x^2) + (x+2)$

$10x^2(x+2) + 1(x+2)$

$(10x^2+1)(x+2)$

Root(s) -2

3) $x^3 + 3x^2 + 10x + 30$

$(x^3 + 3x^2) + (10x+30)$

$x^2(x+3) + 10(x+3)$

$(x+3)(x^2+10)$

Root(s) -3

4) $x^3 - 2x^2 + 4x - 8$

$(x^3 - 2x^2) + (4x-8)$

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

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

Root(s) 2

5) $2x^3 - 5x^2 + 18x - 45$

$(2x^3 - 5x^2) + (18x-45)$

$x^2(2x-5) + 9(2x-5)$

$(2x-5)(x^2+9)$

Root(s) 2.5

6) $-2x^3 - 4x^2 - 3x - 6$

$(-2x^3 - 4x^2) + (-3x-6)$

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

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

Root(s) -2

7) $3x^3 - 6x^2 + x - 2$

$(3x^3 - 6x^2) + (x-2)$

$3x^2(x-2) + 1(x-2)$

$(x-2)(3x^2+1)$

Root(s) 2

8) $2x^3 - x^2 + 2x - 1$

$(2x^3 - x^2) + (2x-1)$

$x^2(2x-1) + 1(2x-1)$

$(2x-1)(x^2+1)$

Root(s) $\frac{1}{2}$

9) $3x^3 - 2x^2 - 9x + 6$

$(3x^3 - 2x^2) + (-9x+6)$

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

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

Root(s) $\frac{2}{3}$ And $\pm\sqrt{3}$

Notes:

1. Group first 2 Terms
2. Group second 2 Terms
3. Look for GCF
4. Factor out GCF

Quadratic Form: Factor the polynomials: Prompt: Use special quadratic ideas to factor... State Root(s)

1) $16x^4-1$

Factored $(4x^2-1)(4x^2+1)$

Root(s) $\pm\sqrt{\frac{1}{4}}$

2) x^4+3x^2+2

Factored $(x^2+2)(x^2+1)$

no Roots

3) x^4-81

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

Roots $\pm\sqrt{3}$

4) $81x^4-256$

$(9x^2-16)(9x^2+16)$

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

Roots $\frac{4}{3}$ And $-\frac{4}{3}$

5) $4x^4-5x^2-9$

Factored

See paper below

6) x^4+10x^2+16

Factored $(x^2+8)(x^2+2)$

7) $81-16x^4$

Factored $(9-4x^2)(9+4x^2)$

8) $32x^6-2x^2$

$2(16x^6-x^2)$

$2x^2(16x^4-1)$

Factored $2(4x^2-1)(4x^2+1)$

Roots $\pm\sqrt{\frac{1}{4}}$

9) $6x^5-51x^3-27x$

Factored

See paper below

Prompt: Mixed Practice: For the following problems, factor the problem completely.

Ideas: Look to factor out the GCF
Is there a special pattern that you recognize?
Once you make it quadratic, can you factor that more?
Try to fit terms in the box

9) $3x^2+11x+6$

$(3x+2)(x+3)$

10) $x^3-4x^2+4x-16$

$(x^3-4x^2)+4x-16$

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

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

11) $125x^3-216$

$5x$ 6

$(5x-6)(25x^2+30x+36)$

12) $2x^7-32x^3$

$2x^3(x^4-16)$

$2x^3(x^2-4)(x^2+4)$

13) $2x^5+4x^4-4x^3-8x^2$

$2x^2(x^3+2x^2-2x-4)$

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

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

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

Roots: 0 -2 $\pm\sqrt{2}$

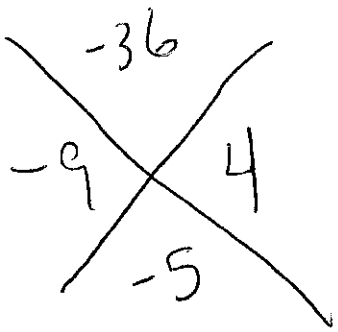
14) $2x^3-32x$

$2x(x^2-16)$

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

Roots 0 4 And -4

(#5) $4x^4 - 5x^2 - 9$

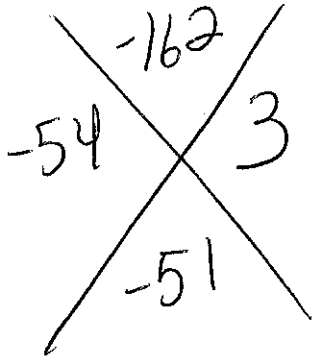


	$4x^2$	-9
x^2	$4x^4$	$-9x^2$
1	$4x^2$	-9

$(4x^2 - 9)(x^2 + 1)$

$(2x-3)(2x+3)(x^2+1)$

(9) $6x^5 - 51x^3 - 27x$



	$3x^2$	-27
$2x^2$	$6x^4$	$-54x^2$
1	$3x^2$	-27

$(3x^2 - 27)(2x^2 + 1)$

$3(x^2 - 9)$

$3(x-3)(x+3)(2x^2+1)$