Lesson 35- Objective: SWBAT use the fundamental theorem of algebra to find the zeros of a polynomial.

Kickoff- Find the zeros of the polynomial.

$f(x)= 4x^6 + 5x^4 - 4x^2 - 5$

$\frac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 4} = \pm 1, \pm 5, \pm\frac{5}{2}, \pm\frac{1}{2}, \pm\frac{1}{4}, \pm\frac{5}{4}$

$f(-1)=0$ $f(1)=0$

	4	0	5	0	-4	0	5
1		4	4	9	9	5	5
-1		4	4	9	9	5	5	0
			-4	0	-9	0	5	
	4	0	9	0	5	0	

$f(x) = (x-1)(x+1)(4x^4+9x^2+5)$

$x-1=0$ $x+1=0$ $4x^4+9x^2+5=0$ (20x)

$x=1$ $x=-1$

$4y^4+4x^2+5x^2+5$

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

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

$4x^2+5=0$ $x^2+1=0$

$\frac{-5}{4}\quad\frac{-5}{4}$ $\sqrt{x^2}=\sqrt{-1}$

$\sqrt{x^2}=\sqrt{\frac{-5}{4}}$ $x=\pm i$

$x=\pm\frac{\sqrt{5}}{2}i$

Zeros $\{-1, 1, \frac{\sqrt{5}}{2}i, -\frac{\sqrt{5}}{2}i, i, -i\}$

(22) $\{1, 1-i, 1+i\}$

(24) $\{-1, -5-2i, -5+2i\}$

(29) $\{2, 2, 2i, -2i\}$

(31) $\{-2, -\frac{1}{2}, i, -i\}$

	1	11	39	29
-1		-1	-10	-29
	1	10	29	0

$x^2+10x+29=0$

$x^2+10x+25=-29+25$

$(x+5)^2=-4$

(31) $2x^2+2=0$

$\frac{2x^2}{2}=\frac{-2}{2}$

$\sqrt{x^2}=\sqrt{-1}$

$x=\pm i$

Fundamental Theorem of Algebra

Try This: Find the zeros.

$f(x) = x^2 + 6x + 45 = 0$

Zeros

$\{-3+6i, -3-6i\}$

$x=-3+6i$ $x=-3-6i$

$+3-6i$ $+3-6i$ $+3+6i$ $+3+6i$

$x+3-6i=0$ $x+3+6i=0$

Linear factors

$(x+3-6i)(x+3+6i)$

$x^2+6x+9=-45+9$

$\sqrt{(x+3)^2}=\sqrt{-36}$

$x+3=\pm 6i$

$-3\quad -3$

$x=-3\pm 6i$

Solving Polynomial Functions

- Factoring
- Higher Power Factoring
- Use synthetic division to find factors

* Only use Quadratic Formula and complete the square FOR QUADRATICS!
- Write as linear factors

Examples: Find the zeros and write as linear factors.

1) $f(x) = x^3 + 4x$

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

$x=0$ $x^2+4=0$

$-4\quad -4$

$\sqrt{x^2}=\sqrt{-4}$

$x=\pm 2i$

Zeros $\{0, 2i, -2i\}$

Linear factors $(x)(x-2i)(x+2i)$

2) $f(x) = x^4 - x^2 - 20$

$x^4+4x^2-5x^2-20$

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

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

$x^2+4=0$ $x^2-5=0$

$x=\pm 2i$ $x=\pm\sqrt{5}$

Zeros $\{-2i, 2i, \sqrt{5}, -\sqrt{5}\}$

LF $(x+2i)(x-2i)(x+\sqrt{5})(x-\sqrt{5})$

3) $f(x) = 5x^4 - 245 = 0$

$\frac{5}{5}$

$x^4-49=0$

$(x^2-7)(x^2+7)=0$

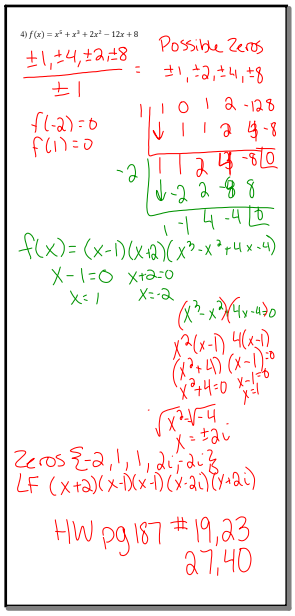
$x^2-7=0$ $x^2+7=0$

$\sqrt{x^2}=\sqrt{7}$ $\sqrt{x^2}=\sqrt{-7}$

$x=\pm\sqrt{7}$ $x=\pm i\sqrt{7}$

Zeros $\{\sqrt{7}, -\sqrt{7}, i\sqrt{7}, -i\sqrt{7}\}$

LF $(x-\sqrt{7})(x+\sqrt{7})(x-i\sqrt{7})(x+i\sqrt{7})$



Practice:

1) $f(x) = x^4 - 16$

2) $h(x) = x^4 - x^3 - 9x^2 - 3x - 36$

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

4) $j(x) = x^4 - 6x^3 - 11x^2 + 86x - 120$

5) $f(x) = x^5 - 8x^4 + 87x^3 - 284x^2 + 268x$