Pre-Calculus Name: ______________________________

Notes (A.2): Factoring Polynomial Functions

	Example #1	Example #2	Example #3	Example #4
	$x^6 - 16x^2$	$-7y^4 - 56y$	$8x^2y - 20xy - 12y$	$3x^3 + 15x^2 - 12x - 60$
Factor out the GCF (if there is one)	$x^2(x^4 - 16)$	$-7y(y^3+8)$	$4y(2x^2-5x-3)$	$3(x^3+5x^2-4x-20)$
	2 terms	2 terms	3 terms	4 terms

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

Identify the method of factoring by the number of terms. → **Binomial** (2 terms) means either or | **Trinomial** (3 terms) means either or | **Polynomial** (4+ terms)

- The difference of squares $(a^2 - b^2) = (a + b)(a - b)$
- The sum or difference of cubes $(a^3 \pm b^3) = (a \pm b)(a^2 \mp ab + b^2)$
- Slide & Divide
- Split the Middle Term
- Grouping

"SOAP"
same, opposite, always positive

Example #1:

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

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

Example #2:

$\boxed{-7y(y+2)(y^2-2y+4)}$

Example #3:

$\boxed{4y(x-3)(2x+1)}$

Example #4:

$3[x^2(x+5)-4(x+5)]$

$3(x+5)(x^2-4)$

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

Always check to see if there is more factoring to do... ☺

$8x^3 - 27$

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

$a = 2x \quad b = 3$

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

$6x^2+11x-10$

$x^2+11x-60$

$(x+\frac{15}{6})(x-\frac{4}{6})$

$(x+\frac{5}{2})(x-\frac{2}{3})$

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

NOW YOU TRY ☺

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

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

$\boxed{-2x(x+1)(x-1)}$

2) $54x^3 - 128$

$2(27x^3-64)$ $a = 3x$, $b = 4$

$\boxed{2(3x-4)(9x^2+12x+16)}$

3) $-36x^3y + 15x^2y + 6xy$

$-3xy(12x^2-5x-2)$

$\boxed{-3xy(4x+1)(3x-2)}$

4) $60x^3 + 40x^2 - 135x - 90$

$5(12x^3+8x^2-27x-18)$

$5[4x^2(3x+2)-9(3x+2)]$

$5(3x+2)(4x^2-9)$

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

5) $x^4 - 29x^2 + 100$

$(x^2-4)(x^2-25)$

$\boxed{(x+2)(x-2)(x-5)(x+5)}$

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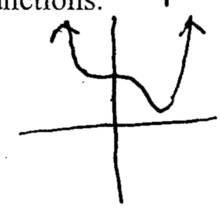
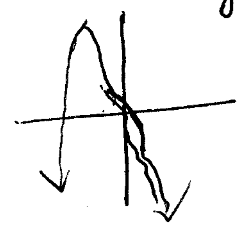
Notes (2.3) – Polynomial Functions

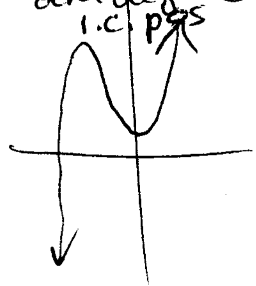
Graphing Polynomial Functions

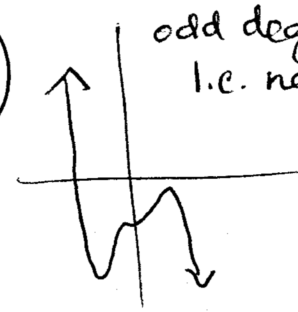
Investigation 1 - End Behavior:

1. Using a graphing calculator, graph the following functions:
a. $y = 3x^4 - 7x^3 + x^2 + 9$
b. $y = -1/2x^6 - 4x^5 + 2x^3 - 11x + 5$
c. $y = 2x^3 + 5x2 - 3x + 1$
d. $y = -3x^5 + 7x^3 - 5$

even degree
l.c. pos.
a) 

even
l.c. neg
b) 

odd degree
l.c. pos
c) 

odd degree
l.c. neg
d) 

2. What affects the right end behavior?

l.c. + "a" $\lim_{x\to\infty} f(x) = \infty$
− "a" $\lim_{x\to\infty} f(x) = -\infty$

3. What affects the left end behavior?

degree "n" even $\lim_{x\to-\infty} f(x) =$ R.E.B.
"n" odd $\lim_{x\to-\infty} f(x) =$ opposite of R.E.B.

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*****Graphing Polynomial Functions*****

Not only are graphs of polynomials unbroken without jumps or holes, but they are *smooth*, unbroken lines or curves, with no sharp corners or cusps.

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THEOREM ----A polynomial function of degree __n__ has at most __n-1__ local (max/min) extrema and at most __n__ zeros.

End Behavior of Polynomial Functions

In order to determine the end behavior of a polynomial function you need only 2 pieces of information:

1st: You must know the __degree__ of the polynomial. If the __degree__ is __even__ the LEFT END BEHAVIOR (L.E.B) & the RIGHT END BEHAIVOR (R.E.B) will be __the same__. If the __degree__ is __odd__ then the L.E.B. and the R.E.B. will be __the opposite__

2nd: You must know the sign of the __leading coefficient__ (__L.C.__) of the polynomial. If the __l.c.__ is **POSITIVE** then the R.E.B. will be: $\lim_{x\to\infty} f(x) =$ __∞__. However, if the __l.c.__ is **NEGATIVE** then the R.E.B. will be: $\lim_{x\to\infty} f(x) =$ __−∞__.