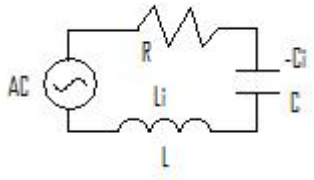
M^2 = Math Mediator Lesson 37: Polynomial Operations

Total Recall (Warm-up) (5 minutes approx.)	Total Recall: Exercises based on yesterday's lesson on graphing and analyzing polynomials: 1. $4x^4 + 2x^3 + 3x^2 - 2x - 6$ is a 4^{th} degree polynomial and more specifically called a: a) quadratic; b) cubic; c) quartic; d) linear (Pick one) equation. Answer: C) Quartic. 2. A cubic function crosses the x-axis at -2, 2 and 5. Write a function if the 'a' value is 2. Answer: $f(x) = 2(x + 2)(x - 2)(x - 5)$.
Direct Instruction: (15 minutes approx.) **CA Std 3.0, 4.0 and 10.0**	MOTIVATION: Polynomials are used to model data and shapes. Sales data for homes from 2000 to 2008 have seen a trend of growth in the earlier years and decline in the later years. The shape is like a bell, and could be modeled by a quadratic (parabola) function or by a portion of a higher order function (cubic, quartic, etc…). Realtors and those professions in the housing business (construction) are very interested in trends and projections of this type of data. Another use for polynomials is evaluating electronic circuits. With respect to frequency and wavelengths, a circuit containing a resistor (R), inductor (L) and  capacitor (C) : is represented by an impedance of: $Z(s) = \frac{s^2LC + sRC + 1}{sC}$ where 's' is a representation of frequency. TECHNIQUE: In order to solve these types of equations, we need to develop some tools and methods on simplifying and solving polynomials. **Method #1:** When adding or subtracting polynomials, combine like terms, specially terms where the variable has the same exponent. Example: $(3x^2 + 2x + 1) + (4x^2 - 2x + 5) = 3x^2 + 4x^2 + 2x - 2x + 1 + 5$ which equals: $7x^2 + 0x + 6 = 7x^2 + 6$ U-DO: Housing construction people are constantly monitoring the housing prices and comparing them with the cost of materials to build a home. As long as the home sale price is above the cost of the materials, a company has a chance to make a profit. If the housing trend from 2003 – 2008 is represented by: $-30x^2 + 180x + 230$; and the material cost trend 2003 – 2008 is represented by: $1.1x + 100$; Subtract the two equations and plot the resulting equation on your graphing calculator to find the year where materials cost more than the selling price of a home: $(-30x^2 + 180x + 230) - (1.1x + 100) = ?$ (x = 0 is year 2000; y is in thousands) Answer: $-30x^2 + 178.9x + 130$ is the resulting equation; the year is middle of 2006.

	What other costs go into building a home? Answer: Labor, fees/permits.
Direct Instruction and Practice: (10 minutes approx.)	Multiplying Polynomials: **Method #2:** FOIL method: $(x + 2)(x + 1) = \{(F)irst\}\ x \cdot x + \{(O)uter\}\ x \cdot 1 + \{(I)nner\}\ 2 \cdot x + \{(L)ast\}\ 2 \cdot 1 = x^2 + x + 2x + 2 = x^2 + 3x + 2$ **Method #3:** FOIL then distribute: $(x + 2)(x + 1)(x – 5) = (x^2 + 3x + 2)(x – 5) =$ $(x^2 + 3x + 2)(x) - (x^2 + 3x + 2)(5) =$ $(x^3 + 3x^2 + 2x) – (5x^2 + 15x + 10) =$ $x^3 + 3x^2 – 5x^2 + 2x – 15x – 10 =$ $x^3 – 2x^2 – 13x – 10$. U-DO: Multiply the following Polynomials: 1. $(x – 3)(x + 2)(x + 1)$ Answer: $x^3 – 0x^2 – 7x – 6$. 2. $(2x – 5z)(3x + 2z)$ Answer: $6x^2 – 11xz – 10z^2$.
Direct Instruction: (10 minutes)	Interesting Polynomial Products: 1. Difference of Squares: $(x + 2)(x – 2) = x^2 + 2x – 2x – 2^2 = x^2 – 4$ $(a + b)(a – b) = a^2 - b^2$ 2. Perfect Square: $(x – 2)^2 = x^2 – 2x – 2x + 2^2$ or: $(a – b)^2 = a^2 – 2ab + b^2$ $(x + 2)^2 = x^2 + 2x + 2x + 2^2$ or: $(a + b)^2 = a^2 + 2ab + b^2$ 3. Cubes: $(x – 2)^3 = x^3 – 6x^2 + 12x + 2^3$ or $(a – b)^3 = a^3 – 3a^2b + 3ab^2 + b^3$ $(x + 2)^3 = x^3 + 6x^2 + 12x + 2^3$ or $(a – b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
Practice (10 minutes approx.)	U-DO: Multiply the following Polynomials: 1. $(3t^2 + 4)(3t^2 – 4)$ Answer: $9t^4 – 16$ 2. $(x + 5)^2$ Answer: $x^2 + 10x + 25$ 3. $(x – 5)^3$ Answer: $x^3 – 15x^2 + 75x + 125$
Wrap-up (5 minutes approx.)	Wrap up closing comments and housekeeping.