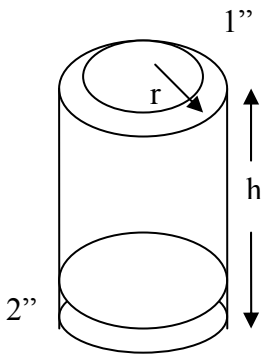
M^2 = Math Mediator Lesson 39: Polynomial Division

Total Recall (Warm-up) (5 minutes approx.)	Total Recall: Exercises based on yesterday's lesson on polynomial factoring: 1. $4c^5 = 64c^3$ Find solution(s) for 'c'. Answer: c = 0, 4, -4 2. $5x^3 + 15x^2 + 12x + 36 = 0$ Find 'x'. Hint: (use grouping) a. Answer: $5x^2(x + 3) + 12(x + 3) = (5x^2 + 12)(x + 3) = 0$ which leads to: $5x^2 + 12 = 0$ or x = ±sq.rt.(-12/5) irrational along with x + 3 = 0, or x = -3.
Motivation Activity: (10 minutes approx.) **CA Std 3.0, 4.0 and 8.0**	Up until now the polynomials that have been presented and factored have been fairly simple. Exponents on the orders of 2^{nd}, 3^{rd} and 4^{th} powers have been mainly the highest seen. Factoring these polynomials and finding the zeros were done by quadratic equation, graphing, or factoring. Today, the technique of long division of polynomials will be presented. Students might ask, why should we do this when our calculators will give us the answer. Show them this exercise to motivate them on why the calculator is limited. Suggest working in small groups: Find the solutions for 'x' in the following polynomial: $x^5 - 6x^4 + 27x^3 - 102x^2 + 176x - 96 = 0$ (Okay to use calculators) From the calculators, they may find solutions of 1, 2, and 3; but the other solutions are not well defined because: $(x - 1)(x - 2)(x - 3) = x^3 - 6x^2 + 11x - 6$ does not equal initial eq. Some terms are missing to get to the initial x^5 power.
Direct Instruction: (10 minutes approx.)	Teaching <u>LONG DIVISION</u>: By example of the above stated problem, there was only a portion of the solution found by using the graphing calculator. In order to find the remaining solutions, divide the original expression by the expression obtained from the calculator solutions. $$\begin{array}{r} \qquad\qquad\qquad\qquad x^2 + 16 \\ x^3 - 6x^2 + 11x - 6 \overline{)\, x^5 - 6x^4 + 27x^3 - 102x^2 + 176x - 96} \\ \text{subtract} \quad x^5 - 6x^4 + 11x^3 - 6x^2 \\ \hline 0 - 0 + 16x^3 - 96x^2 + 176x - 96 \\ \text{subtract} \quad 16x^3 - 96x^2 + 176x - 96 \\ \hline 0 \end{array}$$ Therefore the remaining two solutions for 'x' are found by taking our result from the long division, setting it equal to zero: $x^2 + 16 = 0$ or $x = \pm\sqrt{-1}\sqrt{16} = \pm 4i$
Practice and Demonstrate: (13 minutes)	U_DO: (Suggest working in groups, from earlier) 1. Use your calculator to find zeros, then use long division to find remaining zeros, if any. $x^5 - 5x^4 + 11x^3 - 37x^2 + 18x - 72 = 0$ Solution: From graphing calculator: x = -1, 2, and 4 are solutions; $(x + 1)(x - 2)(x - 4) = x^3 - 5x^2 + 2x + 8 = 0$

	Using long division to find the remaining solutions: $x^2 + 9$ $x^3 - 5x^2 + 2x + 8 \overline{)\, x^5 - 5x^4 + 11x^3 - 37x^2 + 18x - 72}$ subtract $x^5 - 5x^4 + 2x^3 - 8x^2$ $0 - 0 + 9x^3 - 45x^2 + 18x - 72$ subtract $9x^3 - 45x^2 + 18x - 72$ 0 The remaining solutions are $x^2 + 9 = 0$ or $x = \pm 3i$
Self Discovery and practice: (10 minutes approx.)	U-DO: Divide the following, keeping any remainders in fraction form: 1. $\frac{683}{4}$ Answer: $170\frac{3}{4}$ 2. $\frac{x^3 + 7x^2 - 9x}{x - 2}$ Answer: $x^2 + 9x - 9$ r $\frac{2}{x-2}$
Practice (5 minutes approx.)	U-DO: You are having a party and need a cooler to dispense 725 in^3 (approximately 25 pints) of iced tea. Your friends have some various sizes of coolers and they are all cylindrical. They all have a ratio of 2 times the radius is the height. They all have a 1" thickness of insulation around the sides and 2" of insulation on the bottom. What is the minimum radius size for the cooler using the formula for the cylindrical cooler: volume = $\pi r^2 h$ (cylinder volume)?  $725 = \pi (r - 1)^2 (2r - 2)$ which is: $2\pi r^3 - 6\pi r^2 + 6\pi r - 2\pi - 725 = 0$ Solving this on the calculator gives the solution (r = x) between 5" & 6".
Wrap-up (2 minutes approx.)	Wrap up closing comments and housekeeping.