***In division** we use these terms to describe what is being divided, the divisor, and the answer we arrive at:*

$$\begin{array}{l|l} & \textit{Quotient} \\ \hline \textit{Divisor} & \textit{Dividend} \end{array} \qquad\qquad \textit{Ex: } \begin{array}{r|l} & 3 \\ \hline 2 & 6 \end{array}$$

In the example, 2 is the divisor, 6 is the dividend, and 3 is the quotient.

Long Division of Polynomials

Long division of polynomials is done almost the same way as long division of integers.

Example 1

$(x^2 + 10x \quad + 21) \div (x + 3)$

$$\begin{array}{rl} & \underline{\qquad x + 7\quad} \\ x + 3\,) & x^2 + 10x \quad + 21 \\ & \underline{-(x^2 + 3x)} \\ & \qquad 7x \quad + 21 \\ & \qquad \underline{-(7x \quad + 21)} \\ & \qquad\qquad 0 \end{array}$$

Example 2

$(4x^4 - 4x^2 + 6x) \div (x - 4)$

$$\begin{array}{rl} & \underline{\qquad 4x^3 + 16x^2 + 60x + 246} + \frac{984}{x-4} \\ x - 4\,) & 4x^4 + 0x^3 - 4x^2 + 6x + 0 \\ & \underline{-(4^4 - 16x^3)} \\ & \qquad 16x^3 - 4x^2 \\ & \qquad \underline{-(16x^3 - 64x^2)} \\ & \qquad\qquad 60x^2 + 6x \\ & \qquad\qquad \underline{-(60x^2 - 240x \quad)} \\ & \qquad\qquad\qquad 246x \quad + 0 \\ & \qquad\qquad\qquad \underline{-(246x \quad - 984)} \\ & \qquad\qquad\qquad\qquad 984 \end{array}$$

In polynomial long division, the most important thing to remember is that ALL terms must be accounted for. If the dividend is missing a term, you must substitute a "0" term in as a place holder.

1. Begin by dividing the first term of the divisor into the first term of the dividend – (basically you want the terms to "match". Ask yourself "What should I do to the divisor to make it look like the dividend?"
2. Multiply each term in the divisor by the first term of the quotient
3. Subtract the product from the dividend
4. Bring down the next term in the dividend
5. Repeat until finished
6. If there is a remainder, this term must be added on the end as a factor. (Being divided by the divisor)