CLASS NOTES

SYNTHETIC DIVISION

When factoring or evaluating polynomials we often find that it is convenient to divide a polynomial by a linear (first degree) binomial of the form x-k where k is a real number. In certain problems we must use trial-and-error to find a particular value of k. The resulting process of repeated divisions can be tedious and time-consuming. The use of **synthetic division** (instead of long division) can save a lot of time and effort.

It must be emphasized that synthetic division may $\underline{\rm only}$ be used when dividing a polynomial by a binomial of the form x-k .

Illustration: Suppose we wish to divide the polynomial $P = 5x^3 - 6x^2 - 28x - 2$ by x - 3. The k-value is 3 (the number subtracted from x in the binomial x - 3). $P = 5x^3 - 6x^2 - 28x - 2$ by x - 3. The k-value is 3 (the number subtracted from x in the binomial x - 3). $P = 5x^3 - 6x^2 - 28x - 2$ by x - 3. The x - 3 is a polynomial of degree 3, and the four coefficients of $P = 5x^3 - 6x^2 - 28x - 2$ by x - 3.

The division may now be expressed as shown below. Note that there is a blank space above the horizontal line.

We "bring down" (copy) the leading coefficient below the line in the same column.

We now multiply 5 (the number below the line in the first column) by the k-value (3) and write the result in the next column (second column) above the line.

Then we add the two numbers that are above the line in the second column and write the sum below the line.

We now multiply 9 (the number below the line in the second column) by the k-value (3) and write the result in the next column (third column) above the line.