MHF 4U
DIVIDING POLYNOMIALS

Let $P(x)$ = a polynomial of degree n.
Let $D(x)$ = the divisor (another polynomial with degree n or less)
Let $Q(x)$ = the quotient $[degree_{P(x)} - degree_{D(x)}]$
Let $R(x)$ = the remainder

There are 2 methods of dividing polynomials: long division & synthetic division.
The division statement, when 2 polynomials are divided, is expressed as follows:

$$P(x) \div D(x) = Q(x) + \frac{R(x)}{D(x)} \qquad \text{OR} \qquad P(x) \div D(x) = Q(x) \cdot D(x) + R(x)$$

① LONG DIVISION:

EXAMPLES:

1. Divide $2x^3 + 3x^2 + 6$ by $x + 3$. State restrictions on the variables.

2. Divide $10x^2 + 8x^4 - 30x - 3$ by $2x - 5$. State restrictions.

3. $(3x^2 - 2x - 8) \div (3x + 4)$

4. Is $x + 2$ a factor of $13x - 2x^3 + x^4 - 6$?

5. The volume of a rectangular solid is given by $V(x) = x^3 + 11x^2 + 38x + 40$. One side length is $x + 2$. Find expressions for the other 2 side lengths.

② SYNTHETIC DIVISION:

EXAMPLES:

1. Divide $2x^3 + 3x^2 + 6$ by $x + 3$.

2. Divide $10x^2 + 8x^4 - 30x - 3$ by $2x - 5$.

3. $(3x^2 - 2x - 8) \div (3x + 4)$

4. If $ax^3 + 8x^2 + x - 2$ is divided by $x + 2$, the remainder is 12. Determine a.

5. $2x + 3$ is a factor of $f(x) = 6x^3 + 5x^2 - 16x - 15$. Determine the other factors, zeros, and y-intercept. Then sketch the function.

6. When $x^4 + 3x^3 + mx^2 + nx - 8$ is divided by $x + 3$, the remainder is 10. If $x + 1$ is a factor, find the values of m and n.