Descarte's Rule of Signs

When solving these polynomial equations use the rational zero test to find all possible rational zeros first. Synthetic division will then be used to test each one of these possible zeros, until some are found that work. When we found all possible rational zeros of the equation $2x^4 + 7x^3 - 4x^2 - 27x - 18 = 0$, *there were 18 possible solutions to this equation. It could take a very long time to test each one. Luckily there is a rule to help narrow down these choices. Descarte's Rule of Signs can help to narrow the search of possible solutions to the equation.*

Descarte's Rule of Signs

- **The number of positive zeros can be found by counting the number of sign changes in the problem. The number of positive zeros is that number, or less by an even integer.**

- **The number of negative zeros can be found by evaluating $f_{(-x)}$. Count the number of sign changes, and the number of negative zeros is that number, or less by an even integer.**

When using Descarte's Rule of Signs, "less by an even integer," means subtract by two until there is 1 or 0 possible zeros.

Here is an example of how to use Descarte's rule of Signs to determine the possible number of positive and negative zeros for the equation $2x^4 + 7x^3 - 4x^2 - 27x - 18 = 0$.

To find the number of positive roots, count the number of sign changes in $2x^4 + 7x^3 - 4x^2 - 27x - 18 = 0$.

The signs only change once in the original equation, so there is only 1 positive zero.

Evaluating $f_{(-x)}$ *results in* $2x^4 - 7x^3 - 4x^2 + 27x - 18 = 0$. *To evaluate* $f_{(-x)}$, *substitute –x for x. When this is done, only the terms were variables are being raised to odd powers change signs.*

Here, the signs changed 3 times. That means there are either 3 or 1 negative zeros.

Knowledge of complex roots will be used in conjunction with Descarte's Rule of Signs to create a table of possible combinations. Remember, COMPLEX NUMBERS ALWAYS COME IN CONJUGATE PAIRS when solving equations.