Dividing Polynomials

There are two ways to go about dividing polynomials:

1. Long Division
   - This is a similar process as you would have done long division back in lower elementary classes, but obviously a lot more involved.

2. Synthetic Division
   - This is a process that takes the variables out of the entire situation until you bring them back in the end.
   - Typically the preferred method of the two.

Which one do you have to use?

- For the worksheets you're going to use both.
- For Completion/Accuracy and on you can choose!

Dividing Polynomials
Long Division

Procedure:

1. Be sure that the polynomial and what you are dividing it by are in standard form.
2. If you are missing anything from the variables be sure to put in a zero for it.
   Ex: $x^3 - 5$, you are missing x^2 and x,
   so you need need to have $x^3 + 0x^2 + 0x - 5$
3. Set up as a long division situation.
   Ex: $x^3 - 5 \div x + 1$

   $x + 1 \overline{)\, x^3 + 0x^2 + 0x - 5}$
4. Focus on the x's! What do I need to multipy the x by to get the x term that is in front?
5. Multiply what you needed by what you are dividing by.
6. Place that product under the expression aligning like terms.
7. Subtract
8. Repeat steps 4 through step 7, placing remainders over what you are dividing by.

Long Division Examples

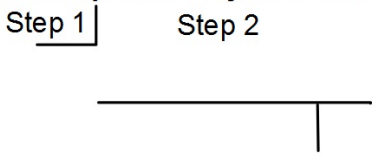
1. $(x^2 + 7x - 30) \div (x - 3)$

2. $(y^5 - 3y^2 - 20) \div (y - 2)$

Dividing Polynomials
Synthetic Division

Procedure:

1. Set the expression you are dividing by equal to zero and solve for the variable.
   Ex: $x^3 - 5$ $x + 1$, So we will take $x + 1 = 0$.
   Subtracting 1 from both sides gives us $x = -1$.
2. Identify all the COEFFICIENTS/CONSTANTS of the expression we are dividing, again filling in zeros for items that are missing.
3. Set up the Synthetic Division:



4. Pull the first number down, multiply the item in the upper left box times that and write it under the 2nd.
5. Repeat until finished.
6. Using the coefficients we have now, on the bottom, reduce the highest exponent from the initial equation and fill them in reducing by 1 each time to move right.

Synthetic Division Examples

1. $(x^2 + 7x - 30) \div (x - 3)$

2. $(y^5 - 3y^2 - 20) \div (y - 2)$