Synthetic Division

Divide $\dfrac{x^3+7x^2+10x-6}{x+3}$:

$$\begin{array}{r|rrrr} -3 & 1 & 7 & 10 & -6 \\ & & -3 & -12 & 6 \\ \hline & 1 & 4 & -2 & 0 \end{array}$$

Go down a level (subtract 1) with the exponents for the variables:

$$1x^2+4x-2$$
$$=x^2+4x-2$$

1. Take the bottom (the divisor) and set to 0 and solve for ***x***. (This may or may not be a factor, depending on whether our remainder is 0.) In our case, we get -3. Put a "corner" around the -3.
2. Take the coefficients of the polynomial on top (the dividend) put them in order from **highest** exponent to **lowest** and put them next to the -3. **If there is a term missing, you have to include a 0 for that term.** For example, for $3x^3-2$, you'd have to put "3 0 −2" (0 for the x^2 that is missing).
3. Bring the first coefficient (1) down.
4. Multiply the -3 by the 1 on the bottom and put the product (-3) under the 7. Add down to get 4.
5. Multiply the -3 by the 4 on the bottom and put the product (-12) under the 10. Add down to get -2.
6. Continue with this pattern until you get to the end of the coefficients. The last number in the bottom right corner is the **remainder**. We got a remainder of 0; this means that $x+3$ goes into $x^3+7x^2+10x-6$ exactly, so it is a **factor**.
7. To get the quotient, use the numbers you got up until the remainder as coefficients, but subtract 1 for each of the terms' exponents.

Long Division **Synthetic Division**

$$\begin{array}{r} 3x^2+9x+29 \\ x-3\overline{)\,3x^3+0x^2+2x-11} \\ \underline{-(3x^3-9x^2)\quad\downarrow} \\ 9x^2+2x \\ \underline{-(9x^2-27x)\quad\downarrow} \\ 29x-11 \\ \underline{-(29x-87)} \\ 76 \end{array}$$

Remainder