Synthetic Division

Divide using Synthetic Division: ONLY possible when the divisor is a linear term- nothing higher than x!
Step 1: Check that the divisor is a linear term in the form $(x - a)$

Step 2: Rewrite the dividend in standard form, filling in any gaps in the exponent order with a coefficient of 0 followed by the missing variable (if needed).

Step 3: In the upper left corner, write the value of "a" from the divisor (watch out for the sign!) Write just the coefficients of the dividend. Leave space underneath followed by a line. Drop down the first coefficient under that line.

Step 4: Multiply the coefficient by the divisor, and write the product under the next coefficient. Add the numbers in the new column.

Step 5: Repeat Step 4 all the way through. Draw a box around the last sum.

Step 6: The boxed number is the remainder. The others are the coefficients of the quotient in order of decreasing exponents. Start with the variable raised to the next highest exponent from the degree. You write the answer as the quotient plus remainder over divisor.

Step 7: If your remainder is 0, then the quotient is your final answer.

Divide using synthetic division.
1. $(x^3 + 3x^2 - 13x - 15) \div (x + 5)$

$$\begin{array}{r|rrrr} -5 & 1 & 3 & -13 & -15 \\ & & -5 & 10 & 15 \\ \hline & 1 & -2 & -3 & \boxed{0} \end{array}$$

$$\boxed{x^2 - 2x - 3}$$

2. $(x^3 - 13x + 12) \div (x + 4)$

$$(x^3 + 0x^2 - 13x + 12) \div (x+4)$$

$$\begin{array}{r|rrrr} -4 & 1 & 0 & -13 & 12 \\ & & -4 & 16 & -12 \\ \hline & 1 & -4 & 3 & \boxed{0} \end{array}$$

$$\boxed{x^2 - 4x + 3}$$

3. $(3x^4 - x^3 + 5x - 1) \div (x + 2)$

$$(3x^4 - x^3 + 0x^2 + 5x - 1) \div (x+2)$$

$$\begin{array}{r|rrrrr} -2 & 3 & -1 & 0 & 5 & -1 \\ & & -6 & 14 & -28 & 46 \\ \hline & 3 & -7 & 14 & -23 & \boxed{45} \end{array}$$

$$\boxed{3x^3 - 7x^2 + 14x - 23 + \frac{45}{x+2}}$$

4. $(3x^2 + 9x - 2) \div (x - \tfrac{1}{3})$

$$\begin{array}{r|rrr} \frac{1}{3} & 3 & 9 & -2 \\ & & 1 & \frac{10}{3} \\ \hline & 3 & 10 & \boxed{\frac{4}{3}} \end{array}$$

$$\boxed{3x + 10 + \frac{\frac{4}{3}}{x - \frac{1}{3}}}$$