HERE IS MORE SYNTHETIC DIVISION

IN THIS EXAMPLE THE LEADING COEFFICIENT OF THE DIVISOR IS NOT 1.

I HOPE THIS EXAMPLE DOESN’T SCARE ANYONE … BUT THERE ARE LOTS OF FRACTIONS IN IT.

PROBLEM: Perform the division using Synthetic Division.

\[
\frac{3x^4 - 5x^3 + x^2 - 12x + 1}{4x + 3}
\]

SOLUTION:
1. “Funny-Factor” the denominator so that the fraction inside the parentheses has the “right” kind of form, i.e. the leading coefficient of the divisor is 1.

\[
\frac{3x^4 - 5x^3 + x^2 - 12x + 1}{4x + 3} = \frac{1}{4} \left( \frac{3x^4 - 5x^3 + x^2 - 12x + 1}{x + \frac{3}{4}} \right)
\]

2. Do the work using S.D. on the quotient inside the parentheses. Don’t worry about all the fractions. They are what they are.

\[
\begin{array}{cccc}
-3/4 & 3 & -5 & 1 & -12 & 1 \\
9/4 & 87/16 & 309/64 & 3231/256 \\
3 & -29/4 & 103/16 & 1077/64 & 3487/256 \\
\end{array}
\]

3. Now plug the results of step 2 into the parentheses, distribute the \(\frac{1}{4}\), and then simplify.

\[
\frac{3x^4 - 5x^3 + x^2 - 12x + 1}{4x + 3} = \frac{1}{4} \left( 3x^3 - \frac{29}{4} x^2 + \frac{103}{16} x - \frac{1077}{64} + \frac{3487}{256} \right)
\]

\[
= \frac{3}{4} x^3 - \frac{29}{16} x^2 + \frac{103}{64} x - \frac{1024}{4x + 3} + \frac{3487}{256}
\]
4. So my final answer is

\[
\frac{3x^4 - 5x^3 + x^2 - 12x + 1}{4x + 3} = 3x^3 - \frac{29}{4}x^2 + \frac{103}{64}x - \frac{1077}{1024} + \frac{3487}{256}
\]