Example: $(3x^3 - 4x^2 - 3x + 5) \div (x - 2)$

$$
\begin{array}{r|l}
x-2 & 3x^2 + 2x + 1 \\
\hline
 & 3x^3 - 4x^2 - 3x + 5 \\
-) & 3x^3 - 6x^2 \\
\hline
 & 2x^2 - 3x \\
-) & 2x^2 - 4x \\
\hline
 & x + 5 \\
-) & x - 2 \\
\hline
 & 7
\end{array}
$$

$$\therefore (3x^3 - 4x^2 - 3x + 5) \div (x - 2) = 3x^2 + 2x + 1 + \frac{7}{x-2}$$

Exercises:

A.

$$
\begin{array}{r|l}
x+1 & x - 6 \\
\hline
 & x^2 - 5x + 4 \\
 & x^2 + x \\
\hline
 & -6x + 4 \\
 & -6x - 6 \\
\hline
 & 10
\end{array}
$$

B.

$$
\begin{array}{r|l}
3x+2 & x^2 - \frac{13}{3}x + \frac{80}{9} \\
\hline
 & 3x^3 - 11x^2 + 18x - 3 \\
 & 3x^3 + 2x^2 \\
\hline
 & -13x^2 + 18x \\
 & -13x^2 - \frac{26}{3}x \\
\hline
 & \frac{80}{3}x - 3 \\
 & \frac{80}{3}x + \frac{160}{9} \\
\hline
 & -\frac{187}{9}
\end{array}
$$

C.

$$
\begin{array}{r|l}
x^2+2x+5 & 2x - 4 \\
\hline
 & 2x^3 + 0x^2 + 4x + 17 \\
 & 2x^3 + 4x^2 + 10x \\
\hline
 & -4x^2 - 6x + 17 \\
 & -4x^2 - 8x - 20 \\
\hline
 & 2x + 37
\end{array}
$$

D.

$$
\begin{array}{r|l}
1-5+6 & 4 + 20 + 59 + 175 \\
\hline
 & 4 + 0 - 17 + 0 + 24 - 3 \\
 & 4 - 20 + 24 \\
\hline
 & 20 - 41 + 0 \\
 & 20 - 100 + 120 \\
\hline
 & 59 - 120 + 24 \\
 & 59 - 295 + 354 \\
\hline
 & 175 - 330 - 3 \\
 & 175 - 875 + 1050 \\
\hline
 & 545 - 1053
\end{array}
$$

A. $(x^2 - 5x + 4) \div (x + 1) = x - 6 + \dfrac{10}{x+1}$

B. $(3x^3 - 11x^2 + 18x - 3) \div (3x + 2) = x^2 - \dfrac{13}{3}x + \dfrac{80}{9} - \dfrac{187}{9(3x+2)}$

C. $(2x^3 + 4x + 17) \div (x^2 + 2x + 5) = 2x - 4 + \dfrac{2x + 37}{x^2 + 2x + 5}$

D. $(4x^5 - 17x^3 + 24x - 3) \div (x^2 - 5x + 6) = 4x^3 + 20x^2 + 59x + 175 + \dfrac{545x - 1053}{x^2 - 5x + 6}$

(with method of detached coefficients of polynomials)