

Polynomials (Part II): Long Division

Name
Date
Course

Perform the following division.

$$\textcircled{1} (2x^5 - 3x^4 - 19x^3 + 33x^2 + 17x - 30) \div (x^2 + 2x - 3)$$

$$\begin{array}{r} 2x^3 - 7x^2 + x + 10 \\ x^2 + 2x - 3 \overline{) 2x^5 - 3x^4 - 19x^3 + 33x^2 + 17x - 30} \\ \underline{2x^5 + 4x^4 - 6x^3} \\ -7x^4 - 13x^3 + 33x^2 + 17x - 30 \\ \underline{-7x^4 - 14x^3 + 21x^2} \\ x^3 + 12x^2 + 17x - 30 \\ \underline{x^3 + 2x^2 - 3x} \\ 10x^2 + 20x - 30 \\ \underline{10x^2 + 20x - 30} \\ 0 \end{array}$$

$$\boxed{2x^3 - 7x^2 + x + 10}$$

$$\textcircled{2} (3x^4 - 26x^3 + 77x^2 - 94x + 40) \div (x - 4)$$

$$\begin{array}{r} 3x^3 - 14x^2 + 21x - 10 \\ x - 4 \overline{) 3x^4 - 26x^3 + 77x^2 - 94x + 40} \\ \underline{3x^4 - 12x^3} \\ -14x^3 + 77x^2 - 94x + 40 \\ \underline{-14x^3 + 56x^2} \\ 21x^2 - 94x + 40 \\ \underline{21x^2 - 84x} \\ -10x + 40 \\ \underline{-10x + 40} \\ 0 \end{array}$$

$$\boxed{3x^3 - 14x^2 + 21x - 10}$$

$$\textcircled{3} (4x^5 + 9x^4 - 3x^3 - 10x^2) \div (4x^3 + 5x^2)$$

$$\begin{array}{r} x^2 + x - 2 \\ 4x^3 + 5x^2 \overline{) 4x^5 + 9x^4 - 3x^3 - 10x^2} \\ \underline{4x^5 + 5x^4} \\ 4x^4 - 3x^3 - 10x^2 \\ \underline{4x^4 + 5x^3} \\ -8x^3 - 10x^2 \\ \underline{-8x^3 - 10x^2} \\ 0 \end{array}$$

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

$$\textcircled{4} (5x^4 - 32x^3 - x^2 + 72x + 36) \div (5x^2 - 7x - 6)$$

$$\begin{array}{r}
 \overline{x^2 - 5x - 6} \\
 5x^2 - 7x - 6 \overline{) 5x^4 - 32x^3 - x^2 + 72x + 36} \\
 \underline{5x^4 - 7x^3 - 6x^2} \\
 -25x^3 + 5x^2 + 72x + 36 \\
 \underline{-25x^3 + 35x^2 + 30x} \\
 -30x^2 + 42x + 36 \\
 \underline{-30x^2 + 42x + 36} \\
 0
 \end{array}$$

$$\boxed{x^2 - 5x - 6}$$

$$\textcircled{5} (2x^5 + 9x^4 + 5x^3 - 30x^2 - 52x - 24) \div (2x + 3)$$

$$\begin{array}{r}
 \overline{x^4 + 3x^3 - 2x^2 - 12x - 8} \\
 2x + 3 \overline{) 2x^5 + 9x^4 + 5x^3 - 30x^2 - 52x - 24} \\
 \underline{2x^5 + 3x^4} \\
 6x^4 + 5x^3 - 30x^2 - 52x - 24 \\
 \underline{6x^4 + 9x^3} \\
 -4x^3 - 30x^2 - 52x - 24 \\
 \underline{-4x^3 - 6x^2} \\
 -24x^2 - 52x - 24 \\
 \underline{-24x^2 - 36x} \\
 -16x - 24 \\
 \underline{-16x - 14} \\
 0
 \end{array}$$

$$\boxed{x^4 + 3x^3 - 2x^2 - 12x - 8}$$

$$⑥ (x^4 + 5x^3 - 5x^2 - 45x - 36) \div (x-3)$$

$$\begin{array}{r} x-3 \overline{) x^4 + 5x^3 - 5x^2 - 45x - 36} \\ \underline{x^4 - 3x^3} \\ 8x^3 - 5x^2 - 45x - 36 \\ \underline{8x^3 - 24x^2} \\ 19x^2 - 45x - 36 \\ \underline{19x^2 - 57x} \\ 12x - 36 \\ \underline{12x - 36} \\ 0 \end{array}$$

$$\boxed{x^3 + 8x^2 + 19x + 12}$$

$$⑦ (4x - 2x^3 + 3x^2 + 20) \div (-6 + x)$$

$$\begin{array}{r} x-6 \overline{) -2x^3 + 3x^2 + 4x + 20} \\ \underline{-2x^3 + 12x^2} \\ -9x^2 + 4x + 20 \\ \underline{-9x^2 + 54x} \\ -50x + 20 \\ \underline{-50x + 300} \\ -280 \end{array}$$

$$-2x^2 - 9x - 50 + \frac{-280}{x-6}$$

$$\boxed{-2x^2 - 9x - 50 - \frac{280}{x-6}}$$

$$⑧ (-2 + x^2 + x^3 + x) \div (x+1)$$

$$\begin{array}{r} x+1 \overline{) x^3 + x^2 + x - 2} \\ \underline{x^3 + x^2} \\ x - 2 \\ \underline{x + 1} \\ -3 \end{array}$$

$$x^2 + 1 + \frac{-3}{x+1}$$

$$\boxed{x^2 + 1 - \frac{3}{x+1}}$$

$$⑨ (3x^3 + 300 - x - 4x^2) \div (4 + x)$$

$$\begin{array}{r} x+4 \overline{) 3x^3 - 4x^2 - x + 300} \\ \underline{3x^3 + 12x^2} \\ -16x^2 - x + 300 \\ \underline{-16x^2 - 64x} \\ 63x + 300 \\ \underline{63x + 252} \\ 48 \end{array}$$

$$\boxed{3x^2 - 16x + 63 + \frac{48}{x+4}}$$

$$(10) (-4x - 5x^3 + 2x^2 + 10) \div (x - 2)$$

$$\begin{array}{r} x-2 \overline{-5x^3+2x^2-4x+10} \\ \underline{-5x^3+10x^2} \\ -8x^2-4x+10 \\ \underline{-8x^2+16x} \\ -20x+10 \\ \underline{-20x+40} \\ -30 \end{array} \quad \boxed{-5x^2-8x-20-\frac{30}{x-2}}$$

$$(11) (x^4 + 7x^3 + 8x^2 - 10x - 1) \div (x^2 - 4)$$

$$\begin{array}{r} x^2-4 \overline{x^4+7x^3+8x^2-10x-1} \\ \underline{x^4-4x^2} \\ 7x^3+12x^2-10x-1 \\ \underline{7x^3-28x} \\ 12x^2+18x-1 \\ \underline{12x^2-48} \\ 18x+47 \end{array} \quad \boxed{x^2+7x+12+\frac{18x+47}{x^2-4}}$$

$$(12) (-4x^3 + x^2 + 5x + 2) \div (4 - 4x + x^3)$$

$$\begin{array}{r} x^3-4x+4 \overline{-4x^3+x^2+5x+2} \\ \underline{-4x^3+16x-16} \\ x^2-11x+18 \end{array} \quad \boxed{-4+\frac{x^2-11x+18}{x^3-4x+4}}$$

$$(13) (6x^4 - x^3 + 2x^2 + 4x + 100) \div (x^2 + 5)$$

$$\begin{array}{r} 6x^2-x-28 \\ x^2+5 \overline{6x^4-x^3+2x^2+4x+100} \\ \underline{6x^4+30x^2} \\ -x^3-28x^2+4x+100 \\ \underline{-x^3-5x} \\ -28x^2+9x+100 \\ \underline{-28x^2-140} \\ 9x+240 \end{array} \quad \boxed{6x^2-x-28+\frac{9x+240}{x^2+5}}$$

$$(14) (5x^4 + 2x^3 - x^2 + 10x + 9) \div (2x^2 + x^4 + 7)$$

$$\begin{array}{r} 5 \\ x^4+2x^2+7 \overline{5x^4+2x^3-x^2+10x+9} \\ \underline{5x^4+10x^2+35} \\ 2x^3-11x^2+10x-26 \end{array} \quad \boxed{5+\frac{2x^3-11x^2+10x-26}{x^4+2x^2+7}}$$

$$(15) (-x^4 + 3x^2 + 2) \div (x+2)$$

$$\begin{array}{r} x+2 \overline{) \begin{array}{r} -x^4 + 3x^2 - x + 2 \\ -x^4 + 2x^3 \\ \hline 2x^3 + 3x^2 - x + 2 \\ 2x^3 + 4x^2 \\ \hline -x^2 - x + 2 \\ -x^2 - 2x \\ \hline 2x + 2 \\ 2x + 4 \\ \hline -2 \end{array}} \\ \hline \end{array}$$

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

$$(16) (x^5 + x - 1) \div (x^2 - 1)$$

$$\begin{array}{r} x^2-1 \overline{) \begin{array}{r} x^5 + x - 1 \\ x^5 - x^3 \\ \hline x^3 + x - 1 \\ x^3 - x \\ \hline 2x - 1 \end{array}} \\ \hline \end{array}$$

$$\boxed{x^3 + x + \frac{2x-1}{x^2-1}}$$

$$(17) (3x^4 - 2x^3 + 4) \div (-x^2 + 5x)$$

$$\begin{array}{r} -x^2+5x \overline{) \begin{array}{r} 3x^4 - 2x^3 + 4 \\ -3x^4 + 15x^3 - 65x^2 + 325x - 4 \\ \hline 13x^3 - 65x^2 + 325x - 4 \\ 13x^3 - 65x^2 \\ \hline 65x^2 - 325x + 4 \\ 65x^2 - 325x \\ \hline 325x + 4 \end{array}} \\ \hline \end{array}$$

$$\boxed{-3x^2 - 13x - 65 + \frac{325x+4}{-x^2+5x}}$$

$$(18) (2x^6 + 2x^2 + 1) \div (x^3 - 3)$$

$$\begin{array}{r} x^3-3 \overline{) \begin{array}{r} 2x^6 + 2x^2 + 1 \\ 2x^6 - 6x^3 \\ \hline 6x^3 + 2x^2 + 1 \\ 6x^3 - 18 \\ \hline 2x^2 + 19 \end{array}} \\ \hline \end{array}$$

$$\boxed{2x^3 + 6 + \frac{2x^2+19}{x^3-3}}$$