

③

$$(x^3 + 7x^2 + 14x + 3) \div (x + 2)$$

$$\begin{array}{r} x^2 + 5x + 4 \\ \hline x^3 + 7x^2 + 14x + 3 \\ - x^3 - 2x^2 \\ \hline 5x^2 + 14x \\ - 5x^2 - 10x \\ \hline 4x + 3 \\ - 4x - 8 \\ \hline -5 \end{array} \quad R: -5$$

Diagram illustrating polynomial division:

- The divisor is $x + 2$, circled in red.
- The quotient is $x^2 + 5x + 4$, written above the division bar.
- The remainder is -5 , written to the right of the division bar.
- Handwritten annotations:
 - A blue curved arrow points from $4(x+2)$ to the first term of the dividend.
 - Red circles highlight the terms x^3 , $5x^2$, $4x$, and the remainder -5 .
 - Blue arrows indicate the subtraction steps: $x^3 - x^3 = 0$, $5x^2 - 5x^2 = 0$, and $4x - 4x = 0$.

2-4b Division of Polynomials

Objectives:

- I can divide one polynomial by another by using synthetic division

Identify the coefficients of the following polynomials # in front of variables

$$f(x) = -5x^3 + 3x^2 - 4x + 7$$

-5 3 -4 7

$$f(x) = 2x^3 + 6x - 1$$

	x^3	x^2	x	constant
→ 2	0	6	-1	

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

opposite sign

$$\begin{array}{r}
 x \\
 +2 \\
 \hline
 | x^3 & 3 & -4 & -12 \\
 \downarrow & & & \\
 + & 2 & 10 & 12 \\
 \hline
 1x^2 & 5x & +6 & 0 \\
 1 \cdot 2 & 5 \cdot 2 & 6 \cdot 2 & \\
 \end{array}$$

Coefficients

Remainder

(A) $\underline{(7x^3 - 6x + 9)} \div (\cancel{x+5})$

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & x^3 & x^2 & x & \text{constant} \\
 -5 | & 7 & 0 & -6 & 9 \\
 & + \downarrow -35 & +175 & -845 \\
 & \hline
 & 7x^2 - 35x + 169 & \boxed{-836} \\
 & 7 \cdot -5 & -35 \cdot -5 & 169.5 & R
 \end{array}
 \\[10pt]
 \boxed{7x^2 - 35x + 169 \quad R: -836}
 \end{array}$$

Long Division

$$\begin{array}{r}
 \overline{3x^2 + 10x + 20} \\
 x - 2 \overline{)3x^3 + 4x^2 + 0x + 10} \\
 - (3x^3 - 6x^2) \\
 \hline
 10x^2 + 0x \\
 - (10x^2 - 20x) \\
 \hline
 20x + 10 \\
 - 20x - 40 \\
 \hline
 50
 \end{array}$$

Synthetic Substitution

$$\begin{array}{r}
 2 | 3 \ 4 \ 0 \ 10 \\
 \hline
 6 \ 20 \ 40 \\
 \hline
 0 \ 10 \ 20 \boxed{50}
 \end{array}$$

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$$(x^3 + 4x^2 + x - 6) \div (x - 1)$$

$$\begin{array}{r}
 +1 \boxed{1} & | x^3 & 4 & | & -6 \\
 + \downarrow & | & 5 & | & 6 \\
 \hline
 | x^2 + 5x + 6 & \boxed{0}
 \end{array}$$

d. Divide $\underline{(x^4 - 3x + 2x^3 - 6)} \div (x - 2)$

$$\begin{array}{r}
 x^4 \quad x^3 \quad x^2 \quad x \quad \text{constants} \\
 \hline
 2 \boxed{1} & | 2 & 0 & -3 & -6 \\
 + \downarrow & 2 & 8 & 16 & 26 \\
 \hline
 | x^3 + 4x^2 + 8x + 13 & \boxed{20}
 \end{array}$$

b. Divide $(x^2 + 2x + 5) \div (x - 2)$

c. Divide $(x^3 + 48) \div (x + 3)$

$$\begin{array}{r} -3 \\ \underline{-} \quad | x^3 \ 0 \ 0 \ 48 \\ + \quad \downarrow -3 \ 9 \ -27 \\ \hline x^2 - 3x + 9 \ \boxed{21} \\ R \uparrow \end{array}$$

$$(7x^3 - 4x^2 - 400x - 100) \div (x - 8)$$

$$\begin{array}{r} 8 | & 7 & -4 & -400 & -100 \\ + & \downarrow & 56 & 416 & 128 \\ \hline 7x^2 + 52x + 1b & & & \boxed{28} \\ & & & R \end{array}$$