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

$$
\begin{array}{r}
x^2 + 5x + 4 \qquad R: -5 \\
(x + 2)\overline{\smash{\big)}\, x^3 + 7x^2 + 14x + 3} \\
-x^3 - 2x^2 \\
\underline{5x^2 + 14x} \\
-5x^2 - 10x \\
\underline{4x + 3} \\
-4x - 8 \\
-5
\end{array}
$$

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

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

$-5 \quad 3 \quad -4 \quad 7$

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

x^3	x^2	x	constant
→ 2	0	6	-1

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

coefficients   opposite sign

x

$+2$ $1x^3 \quad 3 \quad -4 \quad -12$

$+ \qquad \downarrow \quad 2 \quad 10 \quad 12$

$1x^2 + 5x + 6 \quad | 0$

$1 \cdot 2 \qquad 5 \cdot 2 \quad 6 \cdot 2$

remainder

(A) $(7x^3 - 6x + 9) \div (x + 5)$

$$\begin{array}{c|cccc} & x^3 & x^2 & x & \text{constant} \\ -5] & 7 & 0 & -6 & 9 \\ + & \downarrow & -35 & +175 & -845 \\ \hline & 7x^2 & -35x & +169 & -836 \\ & & & & \uparrow \\ & & & & R \end{array}$$

$7 \cdot -5 \quad -35 \cdot -5 \quad 169 \cdot 5$

$$\boxed{7x^2 - 35x + 169 \quad R: -836}$$

Long Division	Synthetic Substitution
$3x^2 + 10x + 20$ $x - 2\overline{)\,3x^3 + 4x^2 + 0x + 10}$ $\underline{-(3x^3 - 6x^2)}$ $10x^2 + 0x$ $\underline{-(10x^2 - 20x)}$ $20x + 10$ $\underline{-20x - 40}$ 50	$\begin{array}{c|cccc} 2] & 3 & 4 & 0 & 10 \\ & & 6 & 20 & 40 \\ \hline & 3 & 10 & 20 & 50 \end{array}$

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

$+1 \rfloor$ $\quad$ $1x^3 \quad 4 \quad 1 \quad -6$

$+ \quad \downarrow \quad 1 \quad 5 \quad 6$

$\overline{}$

$1x^2 + 5x + 6 \quad \lfloor 0$

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

$\quad\quad\quad\quad x^4 \quad x^3 \quad x^2 \quad x \quad$ constants

$2 \rfloor \quad 1 \quad 2 \quad 0 \quad -3 \quad -6$

$+ \quad \downarrow \quad 2 \quad 8 \quad 16 \quad 26$

$\overline{}$

$1x^3 + 4x^2 + 8x + 13 \quad \lfloor 20$

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

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

$$-3 \rfloor \quad | x^3 \quad 0 \quad 0 \quad 48$$
$$+ \quad \downarrow -3 \quad 9 \quad -27$$
$$\overline{\quad | x^2 -3x+9 \quad \lfloor 21 \rfloor}$$
$$R \mathcal{J}$$

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

$$\underline{8\rfloor} \quad \quad 7 \quad -4 \quad \quad -400 \quad -100$$

$$+ \quad \quad \downarrow \quad 56 \quad \quad 416 \quad \quad 128$$

$$7x^2 + 52x + 16 \quad \rfloor \underline{28}$$

$$R$$