

Warm-up:

Solve using LONG DIVISION (hint: put top and bottom in standard form first)

$$\frac{21 - 20x^2 + x^4 + 30x}{5 + x}$$

Standard Form

$$\frac{x^4 + 0x^3 - 20x^2 + 30x + 21}{x + 5}$$

FIRST
 * Standard Form
 * Missing Terms

$$\begin{array}{r} x^3 - 5x^2 + 5x + 5 - \frac{4}{x+5} \\ x+5 \overline{) x^4 + 0x^3 - 20x^2 + 30x + 21} \\ \underline{-x^4 + 5x^3} \\ 5x^3 - 20x^2 + 30x + 21 \\ \underline{+ 5x^3 + 25x^2} \\ 5x^2 + 30x + 21 \\ \underline{- 5x^2 + 25x} \\ 5x + 21 \\ \underline{- 5x + 25} \\ -4 \end{array}$$

Polynomial Synthetic Division

(works only when divisor is a binomial)

$$(x^2 + 5x - 6) \div (x - 2)$$

1: write the solution to divisor=0 in the small square, and the coefficients of the dividend next to it
 $x - 2 = 0$
 $x = 2$

2: bring down the leading coefficient

3: multiply the number in the box by the coefficient, and write it under the next coefficient

4: Add

5: repeat process: the final number is the remainder

6: write out answer: numbers give coefficients to a polynomial

$$\begin{array}{r|rrrr} 2 & 1 & 5 & -6 & \\ & & 2 & 14 & \\ \hline & 1 & 7 & 8 & \end{array}$$

* Standard Form
 * Missing Terms

Start at End:
 - Last # is remainder

$$x + 7 + \frac{8}{x-2}$$

Start at beginning
 → 1st term is one less degree than dividend

$$x + 7 + \frac{8}{x-2}$$

$$\frac{4x^2 + x^3 + 35 - 39x}{x-4}$$

$$\frac{x^3 + 4x^2 - 39x + 35}{x-4}$$

$x-4=0$
 $x=4$

$$\begin{array}{r|rrrr} 4 & 1 & 4 & -39 & 35 \\ & & \downarrow & 4 & 32 & -28 \\ \hline & 1 & 8 & -7 & 7 & \\ & & & & & \frac{7}{x-4} \end{array}$$

$$x^2 + 8x - 7 + \frac{7}{x-4}$$

$$\frac{4y + y^4 + 4y^3 + 12}{4 + y}$$

$$\frac{y^4 + 4y^3 + 0y^2 + 4y + 12}{y+4}$$

$y+4=0$
 $y = -4$

$$\begin{array}{r|rrrrr} -4 & 1 & 4 & 0 & 4 & 12 \\ & & \downarrow & -4 & 0 & 0 & -16 \\ \hline & 1 & 0 & 0 & 4 & -4 \end{array}$$