

- Shortcut for long division
- Only works for linear binomials (Ex.  $(x + 2)$   $(2x - 3)$ )

Examples:

1.  $(2x^2 + 7x + 9) \div (x + 2)$   
Change sign

$$\begin{array}{r|rrr} -2 & 2 & 7 & 9 \\ & \downarrow & + & + \\ & & -4 & -6 \\ \hline & 2 & 3 & 3 \end{array}$$

remainder

$$\left[ 2x + 3 + \frac{3}{x+2} \right]$$

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

$$\begin{array}{r|rrrr} -1 & 1 & 4 & 1 & -6 \\ & \downarrow & + & + & + \\ & & -1 & -3 & 2 \\ \hline & 1 & 3 & -2 & -4 \end{array}$$

$$\left[ x^2 + 3x - 2 - \frac{4}{x+1} \right]$$

3.  $(5x^3 - 6x^2 + 4x - 1) \div (x - 3)$

$$\begin{array}{r|rrrr} 3 & 5 & -6 & 4 & -1 \\ & \downarrow & + & + & + \\ & & 15 & 27 & 93 \\ \hline & 5 & 9 & 31 & 92 \end{array}$$

$$\left[ 5x^2 + 9x + 31 + \frac{92}{x-3} \right]$$

4.  $(2x^4 - 3x^3 - 5x^2 + 3x + 8) \div (x - 2)$

$$\begin{array}{r|rrrrr} 2 & 2 & -3 & -5 & 3 & 8 \\ & \downarrow & + & + & + & + \\ & & 4 & 2 & -6 & -6 \\ \hline & 2 & 1 & -3 & -3 & 2 \end{array}$$

$$\left[ 2x^3 + x^2 - 3x - 3 + \frac{2}{x-2} \right]$$

5.  $(x^3 + 27) \div (x + 3)$

$(x^3 + 0x^2 + 0x + 27) \div (x + 3)$

$$\begin{array}{r|rrr} -3 & 1 & 0 & 0 & 27 \\ & \downarrow & + & + & + \\ & & -3 & 9 & -27 \\ \hline & 1 & -3 & 9 & 0 \end{array}$$

$$\left[ x^2 - 3x + 9 \right]$$

6.  $(3x^4 - x^3 + 5x - 1) \div (x - 3)$

$(3x^4 - x^3 + 0x^2 + 5x - 1) \div (x - 3)$

$$\begin{array}{r|rrrr} 3 & 3 & -1 & 0 & 5 & -1 \\ & \downarrow & + & + & + & + \\ & & 9 & 24 & 72 & 231 \\ \hline & 3 & 8 & 24 & 77 & 230 \end{array}$$

$$\left[ 3x^3 + 8x^2 + 24x + 77 + \frac{230}{x-3} \right]$$

## Factor & Remainder Theorem with Synthetic Division:

7. Is  $(x - 2)$  a factor of  $(3x^3 + 2x^2 - 33)$ ?

Change Sign →

Synthetic

$$(3x^3 + 2x^2 + 0x - 33)$$

$$\begin{array}{r|rrrr} 2 & 3 & 2 & 0 & -33 \\ & \downarrow & + & + & + \\ & & 6 & 16 & 32 \\ \hline & 3 & 8 & 16 & -1 \end{array}$$

$$P(2) = -1 \quad x-2 \text{ is NOT a FACTOR}$$

Plug-In (STO)

2 STO X ENTER

$$P(2) = -1$$

$x-2$  is NOT a factor

8. Is  $x = -4$  a solution to the  $P(x) = x^3 + 2x^2 - 3x + 20$ ?

Do NOT change sign

$$\begin{array}{r|rrrr} -4 & 1 & 2 & -3 & 20 \\ & \downarrow & + & + & + \\ & & -4 & 8 & -20 \\ \hline & 1 & -2 & 5 & 0 \end{array}$$

$$P(-4) = 0$$

$x = -4$  is a solution

9. If  $P(x) = 3x^4 - 25x^2 + 4$ , find  $P(-3)$ .

Do NOT change sign

$$\begin{array}{r|rrrrr} -3 & 3 & 0 & -25 & 0 & 4 \\ & \downarrow & + & + & + & + \\ & & -9 & 27 & -6 & 18 \\ \hline & 3 & -9 & 2 & -6 & 22 \end{array}$$

$$P(-3) = 22$$

$(x+3)$  is Not a factor