Synthetic Division

$12 \div 3 = 4$

12= dividend; 3=divisor; 4=quotient

$x^2 - x + 4$

Constant = 4S

$(x^3 - 3x - 2) \div (x - 2)$ or $\frac{x^3-3x-2}{x-2}$

Step 1: Set up using coefficients of the dividend

(Note: If the exponents do not go in decreasing order, add $0x^n$ to fill the space)

$$\begin{array}{cccc} 1x^3 & +\,0x^2 & -\,3x & -\,2 \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & -3 & -2 \end{array}$$

$$\Downarrow$$

$$\begin{array}{r|rrrr} & 1 & 0 & -3 & -2 \\ & & & & \\ \hline & & & & \end{array}$$

Step 2: Look at the divisor. Take the negative of the constant term

$$x - 2 \;\downarrow\; 2 \qquad \begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & & & \\ \hline & & & & \end{array}$$

Step 3: Bring the first number down

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & \downarrow & & & \\ \hline & 1 & & & \end{array}$$

Step 4: Multiply the bottom number by the left number

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & & & \\ \hline & 1 & & & \end{array}$$

$1 \bullet 2 = 2$

Step 5: Bring that number below the next coefficient

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & & \\ \hline & 1 & & & \end{array}$$

$1 \bullet 2 = 2$

Step 6: Add the second number and the number below it

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & & \\ \hline & 1 & 2 & & \end{array}$$

$0 + 2 = 2$

Step 7: Repeat steps 4-7 until all numbers are used

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & 4 & \\ \hline & 1 & 2 & & \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & 4 & \\ \hline & 1 & 2 & 1 & \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & 4 & 2 \\ \hline & 1 & 2 & 1 & \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & & 2 & 4 & 2 \\ \hline & 1 & 2 & 1 & 0 \end{array}$$

Researched & Developed by: Pi-Rates Add to your knowledge

Synthetic Division

Step 8: Look at the degree(highest exponent) of the dividend, and subtract 1 from that number. This will be the highest exponent in the quotient.

$1x^{3} + 0x^2 - 3x - 2$

$3 - 1 = 2$

2	1	0	-3	-2
		2	4	2
	1	2	1	0

x^{2}

Step 9: Bring the numbers down, which will be the numbers in the quotient

2	1	0	-3	-2
		2	4	2
	1	2	1	0*

$1x^2 + 2x + 1$

Solution:

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

*10. If the last number is not 0, then there is a remainder. After doing steps 1-9, put the last number over the divisor to solve for the remainder.

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

-1	5	-2	4
		-5	7
	5	-7	11

$5x^2 - 7x + \frac{11}{x+1}$

Examples:

#1. $(x^3 + 2x^2 + x) \div (x - 3)$

3	1	2	1
		3	15
	1	5	16

$1x^2 + 5x + \frac{16}{x-3}$

#2. $(x^2 - 9x - 10) \div (x + 1)$

-1	1	-9	-10
		-1	10
	1	-10	0

$1x - 10$