Pre-Calculus 12 Synthetic Division

Synthetic Division is another method used to divide a polynomial by a binomial of the form $x - a$, $a \in \mathbb{Z}$. In this method, the variables are removed and only the coefficients are recorded.

integers

Ex. 1) Divide $6x^3 - 19x^2 + 16x - 4$ by $x - 2$

$x - a$
$x - 2$
$\therefore a = 2$

$$\begin{array}{r|rrrr} 2 & 6 & -19 & 16 & -4 \\ & \downarrow & 12 & -14 & 4 \\ \hline & 6 & -7 & 2 & \boxed{0} \end{array}$$

multiply

add

← remainder

quotient – one degree less

$6x^2 - 7x + 2$

$\therefore 6x^3 - 19x^2 + 16x - 4 = (x-2)(6x^2 - 7x + 2) + 0$

$P(x) = (x-a)\,Q(x) + R$

Ex. 2) Divide $x^4 - 2x + 4 - 10x^2$ by $x + 3$

$x + 3$ $\quad x - a$
$x - (-3)$
$\therefore a = -3$

$x^4 + 0x^3 - 10x^2 - 2x + 4$

↖ placeholder

$$\begin{array}{r|rrrrr} -3 & 1 & 0 & -10 & -2 & 4 \\ & \downarrow & -3 & 9 & 3 & -3 \\ \hline & 1 & -3 & -1 & 1 & \boxed{1} \end{array}$$

$\frac{P(x)}{x+3} = x^3 - 3x^2 - x + 1 + \frac{1}{x+3}$

OR

$\therefore x^4 - 10x^2 - 2x + 4 = (x+3)(x^3 - 3x^2 - x + 1) + 1$

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