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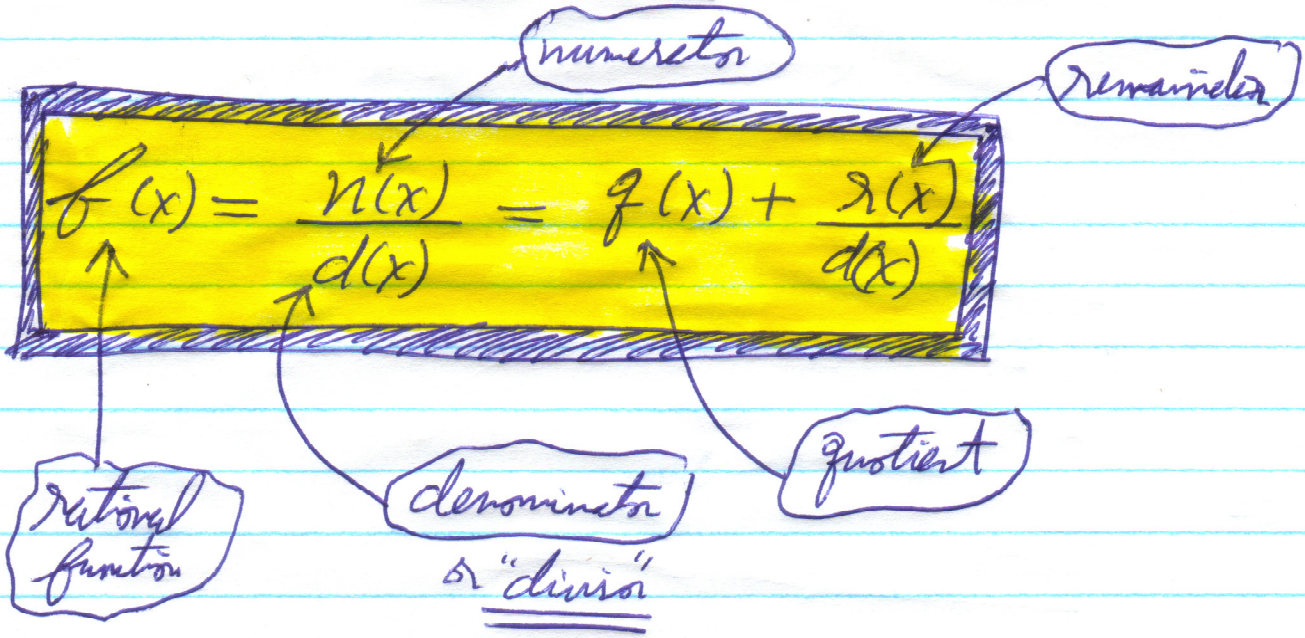
"Long Division" & "Synthetic Division"



Ex: $f(x) = \dfrac{(6x^5+3x^4+2x+1)}{(x-2)}$ ⟸ perform division via "Long-division" (Method #1)

$$\begin{array}{r|l}
6x^5+3x^4+2x+1 & x-2 \\
\hline
-(6x^5-12x^4) & \\
\hline
15x^4+2x+1 & \\
-(15x^4-30x^3) & \\
\hline
30x^3+2x+1 & \\
-(30x^3-60x^2) & \\
\hline
60x^2+2x+1 & \\
-(60x^2-120x) & \\
\hline
122x+1 & \\
-(122x-244) & \\
\hline
245 \leftarrow r(x) & \underbrace{6x^4+15x^3+30x^2+60x+122}_{q(x)}
\end{array}$$

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via "long-division"

$$f(x) = \frac{(6x^5 + 3x^4 + 2x + 1)}{(x-2)} = (6x^4 + 15x^3 + 30x^2 + 60x + 122) + \frac{245}{(x-2)}$$

Let's check if it's correct:

$$f(x) \stackrel{?}{=} \frac{(6x^4 + 15x^3 + 30x^2 + 60x + 122)(x-2) + 245}{(x-2)}$$

$$= \frac{6x^5 + 15x^4 + 30x^3 + 60x^2 + 122x - 12x^4 - 30x^3 - 60x^2 - 120x - 244 + 245}{(x-2)}$$

$$= \boxed{\frac{(6x^5 + 3x^4 + 2x + 1)}{(x-2)}} \Rightarrow \therefore \text{Correct} \ \ddot{\smile}$$

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EX: $f(x) = \dfrac{(6x^5 + 3x^4 + 2x + 1)}{(x-2)}$ ⇒ Perform division using "Synthetic Method" (Method #2)

Step #1: →

$$f(x) = \frac{(6x^5 + 3x^4 + 2x + 1)}{(x-2)} \rightarrow$$

x^5	x^4	x^3	x^2	x	$x^0 = 1$
6	3	0	0	2	1

1	−2

negate values.

−1	2

ignore 1st entry

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Step #2:

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6	3	0	0	2	1
	+12	+30	+60	+120	+244
6	15	30	60	122	245
				quotient	remainder

$$q(x) = 6x^4 + 15x^3 + 30x^2 + 60x + 122$$

$$r(x) = 245$$

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$$\therefore f(x) = \frac{(6x^5 + 3x^4 + 2x + 1)}{(x-2)}$$

$$= (6x^4 + 15x^3 + 30x^2 + 60x + 122) + \frac{(245)}{(x-2)}$$

Via Synthetic Division

the end