

How to do polynomial division

You start with something like this:

$$x-3 \overline{) 2x^2 - 3x - 9}$$



Look at these terms. Ask yourself what $\frac{2x^2}{x}$ equals (same as "x times what gives you $2x^2$?").

We find that $\frac{2x^2}{x} = 2x$, and we put $2x$ on top:

$$x-3 \overline{) 2x^2 - 3x - 9}$$

$2x$

Now we multiply $2x$ by x and -3 , like so:

$$x-3 \overline{) 2x^2 - 3x - 9}$$

$2x^2 - 6x$

We need to cancel out the $2x^2$ now:

$$x-3 \overline{) 2x^2 - 3x - 9}$$

$2x$

$$- (2x^2 - 6x)$$

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$$x-3 \overline{) 2x^2 - 3x - 9}$$

$-2x^2 + 6x$

Distribute the negative to $2x^2$ and $-6x$.

Add down:

$$\begin{array}{r} 2x \\ x-3 \overline{) 2x^2 - 3x - 9} \\ \underline{-2x^2 + 6x} \\ 0 + 3x \end{array}$$

And drop down the -9 :

$$\begin{array}{r} 2x \\ x-3 \overline{) 2x^2 - 3x - 9} \\ \underline{-2x^2 + 6x} \\ 3x - 9 \end{array}$$

Now we ask, what $\frac{3x}{x}$ equals (or "What times x gives us $3x$?").

We find that $\frac{3x}{x} = +3$, and we put $+3$ on top after $2x$, like so:

$$\begin{array}{r} 2x + 3 \\ x-3 \overline{) 2x^2 - 3x - 9} \\ \underline{-2x^2 + 6x} \\ 3x - 9 \end{array}$$

And like before we multiply $+3$ by x and -3 :

$$\begin{array}{r} 2x + 3 \\ x-3 \overline{) 2x^2 - 3x - 9} \\ \underline{-2x^2 + 6x} \\ 3x - 9 \\ \underline{3x - 9} \\ 0 \end{array}$$

And again we ~~add~~ multiply by a negative:

$$\begin{array}{r} 2x+3 \\ x-3 \overline{) 2x^2-3x-9} \\ \underline{-2x^2+6x} \\ 3x-9 \\ \underline{-(3x-9)} \\ 0 \end{array}$$

Distribute the negative to $3x$ and -9 .

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$$\begin{array}{r} \boxed{2x+3} \\ x-3 \overline{) 2x^2-3x-9} \\ \underline{-2x^2+6x} \\ 3x-9 \\ \underline{-3x+9} \\ 0 \end{array}$$

Add down.

We have no other numbers to bring down, so we are finished. In this case, we don't have a remainder.

Our answer to $2x^2-3x-9 \div x-3 = \boxed{2x+3}$.