

## Answer on Question #42690 – Math - Calculus

Divide using synthetic division, and write a summary statement in fraction form.

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

show work please

### Solution:

To convert the polynomial division into the required "mixed number" format, I have to do the division; I will show most of the steps.

First, write down all the coefficients, and put the zero from  $x - 1 = 0$  (so  $x = 1$ ) at the left.

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \end{array}$$

Next, carry down the leading coefficient:

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & & & & & \\ & 2 & & & & & \end{array}$$

Multiply by the potential zero, carry up to the next column, and add down:

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & & & & \\ & 2 & -2 & & & & \end{array}$$

Repeat this process:

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & & & \\ & 2 & -2 & 2 & & & \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & & \\ & 2 & -2 & 2 & 1 & & \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & \downarrow 1 & \\ & 2 & -2 & 2 & 1 & -1 & \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & \downarrow 1 & \nearrow 1 \\ & 2 & -2 & 2 & 1 & -1 & 1 \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & \downarrow 1 & \nearrow 1 \\ & 2 & -2 & 2 & 1 & -1 & 1 \\ & & & & & \downarrow 4 & \\ & 2 & -2 & 2 & 1 & -1 & 4 \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & \downarrow 1 & \nearrow 1 \\ & 2 & -2 & 2 & 1 & -1 & 1 \\ & & & & & \downarrow 4 & \\ & 2 & -2 & 2 & 1 & -1 & 4 \end{array}$$

$$\begin{array}{r|rrrrrr} 1 & 2 & -1 & 0 & 3 & -1 & 5 \\ & \downarrow & \nearrow 2 & \downarrow 2 & \nearrow 1 & \downarrow 1 & \nearrow 1 \\ & 2 & -2 & 2 & 1 & -1 & 1 \\ & & & & & \downarrow 4 & \\ & 2 & -2 & 2 & 1 & -1 & 4 \\ & & & & & & \downarrow 3 \\ & 2 & -2 & 2 & 1 & -1 & 4 \end{array}$$

$$\begin{array}{r|rrrrrr}
 1 & 2 & -1 & 0 & 3 & -1 & 5 \\
 & & 2 & 1 & 1 & 4 & 3 \\
 \hline
 & 2 & 1 & 1 & 4 & 3 & 8
 \end{array}$$

$$\begin{array}{r|rrrrrr}
 1 & 2 & -1 & 0 & 3 & -1 & 5 \\
 & & 2 & 1 & 1 & 4 & 3 \\
 \hline
 & 2 & 1 & 1 & 4 & 3 & 8
 \end{array}$$

$$\begin{array}{r|rrrrrr}
 1 & 2 & -1 & 0 & 3 & -1 & 5 \\
 & & 2 & 1 & 1 & 4 & 3 \\
 \hline
 & 2 & 1 & 1 & 4 & 3 & 8
 \end{array}$$

Putting this result into the required "mixed number" format, I get the answer as being:

$$2x^4 + x^3 + x^2 + 4x + 3 + \frac{8}{x-1}$$

It is always true that, when you use synthetic division, your answer (in the bottom row) will be of degree one less than what you'd started with, because you have divided out a linear factor. That was how I knew that my answer, denoted by the "2 1 1 4 3 8" in the bottom row, stood for a  $x^5$ , since I had started with a quadratic.

**Answer:**  $2x^4 + x^3 + x^2 + 4x + 3 + \frac{8}{x-1}$ .