Answer on Question#56908 - Math - Calculus

Divide. Use synthetic division, if possible.

$$(x^4 + 6x^3 - x^2 - 5x + 1) \div (x - 2)$$

Divide. Use synthetic division, if possible.

$$(x^3 + 9x^2 - 5x + 11) \div (x^2 + 2)$$

Solution:

$(x^4 + 6x^3 - x^2 - 5x + 1) \div (x - 2)$:

The synthetic division table is:

$$\begin{array}{c|ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & 30 & 50 \\ \hline & 1 & 8 & 15 & 25 & 51 \end{array}$$

So we have $$\frac{x^4 + 6x^3 - x^2 - 5x + 1}{x - 2} = x^3 + 8x^2 + 15x + 25 + \frac{51}{x - 2}$$

Explanation

Step 1 : Write down the coefficients of the polynomial $p(x)$. Put the zero from $x - 2 = 0$ ($x = 2$) at the left.

$$\begin{array}{c|ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & & & & \\ \hline & & & & & \end{array}$$

Step 2 : Bring down the leading coefficient to the bottom row.

$$\begin{array}{c|ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & & & & \\ \hline & 1 & & & & \end{array}$$

Step 3 : Multiply by the number on the left, and carry the result into the next column: $2 \cdot 1 = 2$

$$\begin{array}{c|ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & & & \\ \hline & 1 & & & & \end{array}$$

Step 4 : Add down the column: $6+2=8$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & & & \\ \cline{2-6} & 1 & 8 & & & \end{array}$$

Step 5 : Multiply by the number on the left, and carry the result into the next column: $2 \cdot 8 = 16$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & & \\ \cline{2-6} & 1 & 8 & & & \end{array}$$

Step 6 : Add down the column: $-1+16=15$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & & \\ \cline{2-6} & 1 & 8 & 15 & & \end{array}$$

Step 7 : Multiply by the number on the left, and carry the result into the next column: $2 \cdot 15 = 30$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & 30 & \\ \cline{2-6} & 1 & 8 & 15 & & \end{array}$$

Step 8 : Add down the column: $-5+30=25$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & 30 & \\ \cline{2-6} & 1 & 8 & 15 & 25 & \end{array}$$

Step 9 : Multiply by the number on the left, and carry the result into the next column: $2 \cdot 25 = 50$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & 30 & 50 \\ \cline{2-6} & 1 & 8 & 15 & 25 & \end{array}$$

Step 10 : Add down the column: $1+50=51$

$$\begin{array}{c ccccc} 2 & 1 & 6 & -1 & -5 & 1 \\ & & 2 & 16 & 30 & 50 \\ \cline{2-6} & 1 & 8 & 15 & 25 & 51 \end{array}$$

Bottom line represents the polynomial quotient $(x^3+8x^2+15x+25)$ with a remainder of 51.

$(x^3 + 9x^2 - 5x + 11) \div (x^2 + 2)$:

The long division table is:

$$
\begin{array}{r|l}
 & x + 9 \\ \cline{2-2}
x^2 + 2 & x^3 + 9x^2 - 5x + 11 \\
 & x^3 \qquad\quad + 2x \\ \cline{2-2}
 & \qquad 9x^2 - 7x + 11 \\
 & \qquad 9x^2 \qquad\; + 18 \\ \cline{2-2}
 & \qquad\qquad -7x - 7
\end{array}
$$

So we have

$$\frac{x^3 + 9x^2 - 5x + 11}{x^2+2} = x + 9 - \frac{-7x-7}{x^2+2}$$

<u>Answer:</u>

$$\frac{x^4 + 6x^3 - x^2 - 5x + 1}{x-2} = x^3 + 8x^2 + 15x + 25 + \frac{51}{x-2}$$

$$\frac{x^3 + 9x^2 - 5x + 11}{x^2+2} = x + 9 - \frac{-7x-7}{x^2+2}$$