Long Division of Polynomials -

$$\frac{8x^3 - 4x^2 + 7x - 14}{x^3+1} = 8 + \frac{-4x^2 + 7x - 22}{x^3+1}$$

$$\begin{array}{r} 8 \\ x^3+1 \overline{)\ 8x^3 - 4x^2 + 7x - 14} \\ -(8x^3 \qquad\qquad + 8) \\ \hline 0 \quad -4x^2 + 7x - 22 \end{array}$$

← remainder

stop when: degree less than that of the divisor

$$\frac{x^3 + 3x + 5}{x+1} \Rightarrow$$

$$\begin{array}{r} x^2 - x + 4 \\ x+1 \overline{)\ x^3 \quad + 3x + 5} \\ -(x^3 + x^2) \\ \hline -x^2 + 3x + 5 \\ -(-x^2 - x) \\ \hline 4x + 5 \\ -(4x + 4) \\ \hline 1 \end{array}$$

find quotient and remainder:

$$f(x) = x^3 - 8x^2 + 19x - 12 = (x-1)(x-3)(x-4)$$

$x=1 \Rightarrow f(1) = 1^3 - 8 + 19 - 12 = 0$

— $x=1$ is a zero of $f(x)$ —

$\Rightarrow (x-1)$ is a factor of $f(x)$

$$\begin{array}{r} x^2 - 7x + 12 \\ x-1 \overline{)\ x^3 - 8x^2 + 19x - 12} \\ -(x^3 - x^2) \\ \hline -7x^2 + 19x - 12 \\ -(-7x^2 + 7x) \\ \hline 12x - 12 \\ 12x - 12 \\ \hline 0 \end{array}$$

$= (x-3)(x-4)$