Long Division of Polynomials

Recall the division algorithm: $\frac{P(x)}{d(x)} = q(x) + \frac{r(x)}{d(x)}$

Determine $\frac{P(x)}{d(x)}$. If $d(x)$ is not a factor express your answer using the division algorithm. If $d(x)$ is a factor, then rewrite $P(x)$ in completely factored form.

1. $P(x) = 2x^4 - 3x^3 + 2x - 5$
   & $d(x) = x + 1$

*If a term is MISSING, use a placeholder!!

Quotient $q(x)$: $2x^3 - 5x^2 + 5x - 3$

Divisor $d(x)$: $x+1$; Dividend $P(x)$: $2x^4 - 3x^3 + 0x^2 + 2x - 5$

$$\begin{array}{l} x+1 \overline{)\,2x^4 - 3x^3 + 0x^2 + 2x - 5} \\ +(-2x^4 - 2x^3) \\ \quad -5x^3 + 0x^2 \\ \quad +(5x^3 + 5x^2) \\ \qquad 5x^2 + 2x \\ \qquad +(-5x^2 - 5x) \\ \qquad\quad -3x - 5 \\ \qquad\quad +(3x + 3) \\ \qquad\qquad -2 \end{array}$$

Since the remainder is -2, $x + 1$ IS NOT a factor.

We can also rewrite P(x) as $P(x) = q(x) \bullet d(x) + r(x)$

Rewrite P(x) for the example above.

$P(x) = (x+1)(2x^3 - 5x^2 + 5x - 3) - 2$

2. $P(x) = x^3 + 2x^2 - 4x - 8$
   & $d(x) = x + 2$

$$\begin{array}{l} \qquad x^2 + 0x - 4 \\ x+2 \overline{)\,x^3 + 2x^2 - 4x - 8} \\ +(-x^3 - 2x^2) \\ \quad 0 - 4x - 8 \\ \quad +(4x + 8) \\ \qquad 0 \end{array}$$

* $x+2$ is a factor of $p(x)$

$p(x) = (x+2)(x^2 - 4)$

$p(x) = (x+2)(x+2)(x-2)$

$p(x) = (x+2)^2(x-2)$

3. $P(x) = x^3 - 4x^2 - 7x + 10$
   & $d(x) = x - 1$

$$\begin{array}{l} \qquad x^2 - 3x - 10 \\ x-1 \overline{)\,x^3 - 4x^2 - 7x + 10} \\ +(-x^3 + x^2) \\ \quad -3x^2 - 7x \\ \quad +(3x^2 - 3x) \\ \qquad -10x + 10 \\ \qquad +(10x - 10) \\ \qquad\quad 0 \end{array}$$

* $x-1$ is a factor of $p(x)$

$P(x) = (x-1)(x^2 - 3x - 10)$

$P(x) = (x-1)(x-5)(x+2)$

*If possible, FACTOR COMPLETELY!