

$$\begin{array}{r} -(3x^2 + 6x) \\ 4x + 8 \\ \hline \end{array}$$

← 4. Multiply $3x$ by the divisor $x + 2$ and subtract the result from the polynomial. You get $4x + 8$.

$$4x + 8$$

← 5. Divide $4x$ by x . You get 4.

$$\begin{array}{r} -(4x + 8) \\ \hline \end{array}$$

← 6. Multiply 4 by the divisor $x + 2$ and subtract the result from the polynomial. You get 0.

$$0$$

Therefore, we get: $2x^3 + 7x^2 + 10x + 8 = (x + 2)(2x^2 + 3x + 4)$.

In both of these examples, the remainder of dividing $P(x)$ by $K(x)$ is zero. This is not always the case, as is shown in the following example.

EXAMPLE 3.4c: Let $P(x) = -4x^4 + 9x^3 - 12x + 5$ and $K(x) = x^2 + 2$. Divide $P(x)$ by $K(x)$.

SOLUTION: Note, the coefficient of x^2 in polynomial $K(x)$ is one.

$$\begin{array}{r} -4x^2 + 9x + 8 \\ x^2 + 2 \overline{) -4x^4 + 9x^3 + 0 \cdot x^2 - 12x + 5} \\ \underline{-(-4x^4 \quad -8x^2)} \end{array}$$

← 1. Divide $-4x^4$ by x^2 . You get $4x^2$.

← 2. Multiply $4x^2$ by the divisor $x^2 + 2$ and subtract the result from the polynomial. You get $9x^3 + 8x^2$.

$$9x^3 + 8x^2$$

← 3. Divide $9x^3$ by x^2 . You get $9x$.

$$\begin{array}{r} -(9x^3 \quad +18x) \\ \hline \end{array}$$

← 4. Multiply $9x$ by the divisor $x^2 + 2$ and subtract the result from the polynomial. You get $8x^2 - 30x$.

$$8x^2 - 30x$$

← 5. Divide $8x^2$ by x^2 . You get 8.

$$\begin{array}{r} -(8x^2 \quad +16) \\ \hline \end{array}$$

← 6. Multiply 8 by the divisor $x^2 + 2$ and subtract the result from the polynomial. You get $-30x - 11$.

$$-30x - 11$$

Since $-30x$ cannot be divided by x^2 , we have the remainder $-30x - 11$. Therefore, we get:

$$\frac{-4x^4 + 9x^3 + 0 \cdot x^2 - 12x + 5}{x^2 + 2} = -4x^2 + 9x + 8 + \frac{-30x - 11}{x^2 + 2}$$

or

$$-4x^4 + 9x^3 - 12x + 5 = (x^2 + 2)(-4x^2 + 9x + 8) + (-30x - 11)$$