$$-(3x^2+6x)$$ ← 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.

$$-(4x+8)$$ ← 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.

$$-4x^2+9x+8$$

$$x^2+2 \overline{\big)\, -4x^4+9x^3+0\cdot x^2-12x+5}$$ ← 1. Divide $-4x^4$ by x^2. You get $4x^2$.

$$-(-4x^4 \quad -8x^2)$$ ← 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 $9x$.

$$-(9x^3 \quad +18x)$$ ← 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.

$$-(8x^2 \quad +16)$$ ← 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

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