Not the Remainder Theorem (its just algebraic long division)

$$(2x^3+5x^2-7x-10)\div(x+2)$$

a) Divide $2x^3$ (first term) by x

$$2x^3\div x=2x^2$$

b) Multiply answer by $(x+2)$ (the divisor)

$$2x^2(x+2)=2x^3+4x^2$$

c) Subtract this from $(2x^3+5x^2-7x-10)$

$$(2x^3+5x^2-7x-10)-(2x^3+4x^2)=x^2-7x-10$$

$$\begin{array}{r|rrrr} & 2x^2 & & & \\ \hline (x+2) & 2x^3 & +5x^2 & -7x & -10 \\ & -2x^3 & -4x^2 & & \\ \hline & & x^2 & -7x & -10 \end{array}$$

d) Divide x^2 (first term) by x

$$x^2\div x=x$$

e) Multiply answer by $(x+2)$ (the divisor)

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

f) Subtract this from $(x^2-7x-10)$

$$(x^2-7x-10)-(x^2+2x)=-9x-10$$

$$\begin{array}{r|rrrr} & 2x^2 & +x & & \\ \hline (x+2) & 2x^3 & +5x^2 & -7x & -10 \\ & -2x^3 & -4x^2 & & \\ \hline & & x^2 & -7x & -10 \\ & & -x^2 & -2x & \\ \hline & & & -9x & -10 \end{array}$$

g) Divide $-9x$ (first term) by x

$$-9x\div x=-9$$

h) Multiply answer by $(x+2)$ (the divisor)

$$-9(x+2)=-9x-18$$

i) Subtract this from $-9x-10$

$$-9x-10-(-9x-18)=8$$

$$\begin{array}{r|rrrr} & 2x^2 & +x & -9 & \\ \hline (x+2) & 2x^3 & +5x^2 & -7x & -10 \\ & -2x^3 & -4x^2 & & \\ \hline & & x^2 & -7x & -10 \\ & & -x^2 & -2x & \\ \hline & & & -9x & -10 \\ & & & -9x & -18 \\ \hline & & & & 8 \end{array}$$

This gives

$$\begin{array}{r|rrrr} & 2x^2 & +x & -9 & \\ \hline (x+2) & 2x^3 & +5x^2 & -7x & -10 \end{array}$$

Remainder 8

$$(2x^2+x-9)(x+2)=(2x^3+5x^2-7x-10)-8$$

Notes

Remainder Theorem:

For $p(x) \div sx+t$, remainder = $p(\frac{-t}{s})$.

Ie, to find remainder put $\frac{-t}{s}$ into polynomial. Special case when $s=1$.

Factor Theorem:

If $p(\frac{-t}{s})=0$, then $sx+t$ is a factor.

Process for finding factors:

1. Try $p(?)=0$,
2. If / when successful, divide polynomial by this factor to find quotient,
3. Repeat until fully factorised (but gets easier each with each repeat).