4) a) $(x')' = x$

$x' + x = x + x'$ (1a)
$= 1$ (5a)

and
$x' \cdot x = x \cdot x'$ (1b)
$= 0$ (5b)

Therefore $x = (x')'$ by the theorem on the uniqueness of complements.

b) $(x+y)' = x' \cdot y'$, $(x \cdot y)' = x' + y'$

$$
\begin{aligned}
(x+y) + (x' \cdot y') &= ((x+y)+x') \cdot ((x+y)+y') && \text{3a} \\
&= (x+(y+x')) \cdot (x+(y+y')) && \text{2a} \\
&= (x+(x'+y)) \cdot (x+1) && \text{1a,5a} \\
&= ((x+x')+y) \cdot 1 && \text{2a} \\
&= (1+y) \cdot 1 && \text{5a} \\
&= (y+1) \cdot 1 && \text{1a} \\
&= 1 \cdot 1 && \text{Prac 3a} \\
&= 1 && \text{4b}
\end{aligned}
$$

and

$$
\begin{aligned}
(x+y) \cdot (x' \cdot y') &= (x' \cdot y') \cdot (x+y) && \text{1b} \\
&= (x' \cdot y') \cdot x + (x' \cdot y') \cdot y && \text{3b} \\
&= x \cdot (x' \cdot y') + (x' \cdot y') \cdot y && \text{1b} \\
&= (x \cdot x') \cdot y' + x' \cdot (y' \cdot y) && \text{2b} \\
&= 0 \cdot y' + x' \cdot (y \cdot y') && \text{5b, 1b} \\
&= y' \cdot 0 + x' \cdot 0 && \text{1b, 5b} \\
&= 0 + 0 && \text{3b} \\
&= 0 && \text{4a}
\end{aligned}
$$

Now assert the result by the uniqueness of complements.