DeMorgan's Theorem is used in two complementary forms

$$\overline{(A+B+C+\ldots)} = \overline{A}.\overline{B}.\overline{C}\ldots$$
$$\overline{A}+\overline{B}+\overline{C}+\ldots = \overline{(A.B.C\ldots)}$$

In Boolean algebra formalism

$$\begin{aligned}\overline{(A+B)} &= \overline{A}.\overline{B}\\ \text{Compl of Sums} &= \text{Prod of Compl}\\ \overline{A}+\overline{B} &= \overline{(A.B)}\\ \text{Sum of Compl} &= \text{Compl of Prod}\end{aligned}$$

Postulate 4 defines complements,

$$\begin{aligned} A + \overline{A} &= 1 \\ A.\overline{A} &= 0 \end{aligned}$$

Prove first form of DeMorgan's theorem

$$
\begin{aligned}
A + B + \overline{A}.\overline{B} &= (A + B + \overline{A}).(A + B + \overline{B}) && \text{P2} \\
&= (B + 1).(A + 1) && \text{P4} \\
&= 1.1 && \text{T2} \\
&= 1
\end{aligned}
$$

and also

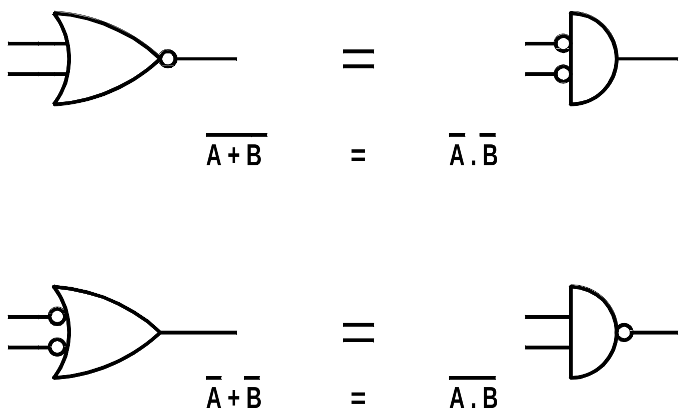
$$
\begin{aligned}
(A + B).\overline{A}.\overline{B} &= \overline{A}.\overline{B}.(A + B) && \text{P1} \\
&= \overline{A}.\overline{B}.A + \overline{A}.\overline{B}.B && \text{P2} \\
&= \overline{B}.\overline{A}.A + \overline{A}.\overline{B}.B \\
&= \overline{B}.0 + \overline{A}.0 \\
&= 0
\end{aligned}
$$

Prove second form of DeMorgan's Theorem

$$\begin{aligned}\overline{A}+\overline{B}+A.B &= (\overline{A}+\overline{B}+A).(\overline{A}+\overline{B}+B) && \text{P2}\\ &= (\overline{B}+1).(\overline{A}+1) && \text{T2}\\ &= 1\end{aligned}$$

and

$$\begin{aligned}(\overline{A}+\overline{B}).A.B &= \overline{A}.A.B+\overline{B}.A.B && \text{P2}\\ &= B.0+A.0 && \text{P4}\\ &= 0\end{aligned}$$



Circuit statement of DeMorgan's theorem. Allows interchange of NAND and NOR logic gates.

Enumerative truth table verification of the first form of the theorem:

A	B	$A+B$	$\overline{A+B}$	$\overline{A}$	$\overline{B}$	$\overline{A}.\overline{B}$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

Enumerative truth table verification of the second form of the theorem:

A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$	$A.B$	$\overline{A.B}$
0	0	1	1	1	0	1
0	1	1	0	1	0	1
1	0	0	1	1	0	1
1	1	0	0	0	1	0