1.State and prove de Morgan's laws of Boolean algebra .also simplify the Boolean expression  $[(X.Y^*).(z+y.w)+x^*.y^*).z]$ .

\*\*De Morgan's Laws:\*\*

De Morgan's Laws in Boolean algebra describe the relationships between negation of a conjunction (AND) and disjunction (OR), and vice versa. There are two laws:

1. \*\*First Law (De Morgan's Law for Negation of Conjunction):\*\*

 $[\nabla A \subset B] = \nabla A + \nabla B$ 

2. \*\*Second Law (De Morgan's Law for Negation of Disjunction):\*\*

\*\*Proof of De Morgan's Laws:\*\*

1. \*\*First Law Proof:\*\*

 $[\nabla A \cdot B] = 1 - (A \cdot B) = (1 - A) + (1 - B) = \nabla A + \nabla B$ 

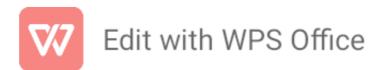
2. \*\*Second Law Proof:\*\*

 $[\nabla A + B] = 1 - (A + B) = (1 - A) \cdot (1 - B) = \nabla A \cdot (1 - B)$ 

\*\*Simplification of the Boolean Expression:\*\*

 $[(X \cdot (Z + Y \cdot W) + \operatorname{X} \cdot Y) \cdot (Z + Y \cdot W) + \operatorname{X} \cdot Y]$ 

Apply distributive law:



## Simplify terms:

 $[(X \cdot V) \cdot Z + 0 + V \cdot X] \cdot X]$ 

Combine terms:

 $[X \cdot V] \cdot Z + \operatorname{Z} \cdot$ 

The simplified Boolean expression is  $(X \cdot Z + \text{V} \cdot$ 

