Translate each of the following four syllogisms into equational arguments.

(1)

All M is P.	$MP' = 0$
All S is M.	$SM' = 0$
All S is P.	$SP' = 0$

(2)

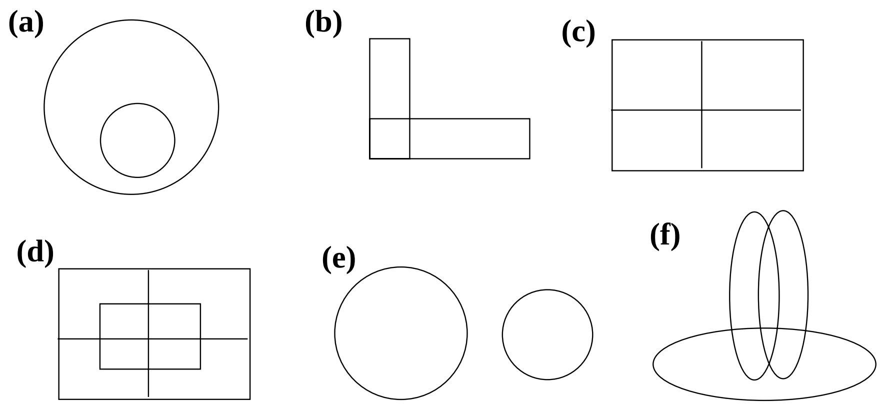
All M is P.	$MP' = 0$
No S is M.	$SM = 0$
No S is P.	$SP = 0$

(3)

All P is M.	$PM' = 0$
No M is S.	$MS = 0$
No S is P.	$SP = 0$

(4)

No M is P.	$MP = 0$
All S is M.	$SM' = 0$
No S is P.	$SP = 0$



Which of the six diagrams above could qualify as **Venn diagrams**?

Answer: (b), (f)

The Expansion Theorem

For the formula $F(A, B) = (AB)'$ carry out the following computations to calculate the expansion of $F(A, B)$ on A, B:

	Full Expression		Value
$F(1,1) =$	$(1\,1)'$	$=$	0
$F(1,0) =$	$(1\,0)'$	$=$	1
$F(0,1) =$	$(0\,1)'$	$=$	1
$F(0,0) =$	$(0\,0)'$	$=$	1

Thus expanding on A, B gives: $F(A, B) = AB' \cup A'B \cup A'B'$

For the formula $F(A,B,C) = (AB)' \cup (BC)$ carry out the following computations to calculate the expansion of $F(A,B,C)$ on A:

	Full Expression		Simplified
$F(1,B,C) =$	$(1\,B)' \cup (BC)$	$=$	$B' \cup C$
$F(0,B,C) =$	$(0\,B)' \cup (BC)$	$=$	1

Expanding on A gives: $F(A,B,C) =$ $(B' \cup C)A \ \cup \ A'$

For the formula $F(A,B,C) = (AB)' \cup (BC)$ carry out the following computations to calculate the expansion of $F(A,B,C)$ on B,C:

	Full Expression		Simplified
$F(A,1,1) =$	$(A\,1)' \cup (1\,1)$	$=$	1
$F(A,1,0) =$	$(A\,1)' \cup (1\,0)$	$=$	A'
$F(A,0,1) =$	$(A\,0)' \cup (0\,1)$	$=$	1
$F(A,0,0) =$	$(A\,0)' \cup (0\,0)$	$=$	1

Expanding on B,C gives: $F(A,B,C) =$ $BC \cup A'BC' \cup B'C \cup B'C'$

Elimination

For the formula $E(A,B,C) = (A(A' \cup B)'C')'$ carry out the following computations to eliminate A from the equation $E(A,B,C) = 0$:

	Full Expression		Simplified
$E(1,B,C) =$	$(1(1' \cup B)'C')'$	$=$	$B \cup C$
$E(0,B,C) =$	$(0(0' \cup B)'C')'$	$=$	1

Eliminating A gives (simplify first!): $B \cup C \quad = \ 0$

For the formula $E(A,B,C,D) = (A \cup B)(C \cup D)$ carry out the following computations to eliminate B, C from the equation $E(A,B,C,D) = 0$:

	Full Expression		Simplified
$E(A,1,1,D) =$	$(A \cup 1)(1 \cup D)$	$=$	1
$E(A,1,0,D) =$	$(A \cup 1)(0 \cup D)$	$=$	D
$E(A,0,1,D) =$	$(A \cup 0)(1 \cup D)$	$=$	A
$E(A,0,0,D) =$	$(A \cup 0)(0 \cup D)$	$=$	AD

Eliminating B, C gives (simplify first!): $AD = 0$

Fill in the following tree to give a proof of the validity of the argument using the method of Lewis Carroll. Be sure to give the number of the reason for each boxed letter.

1 $ACL = 0$

2 $A'I'M' = 0$

3 $GIO' = 0$

4 $A'CM = 0$

5 $C'I'O' = 0$

$LO'G = 0$