Question 1.

Pre-requisite:
Understanding what $\vee, \wedge, \nsim, \rightarrow$ entail.
Understanding contingency, tautology and cont.

p	q	$p \vee q$	$\sim p \rightarrow q$
T	T	T ✓	T ✓
T	F	T ✓	T ✓
F	T	T ✓	T ✓
F	F	F ✓	F ✓

The expression

$(\sim p \rightarrow q) \rightarrow \sim(p \vee q)$

$T \rightarrow F$
$T \rightarrow F$
$T \rightarrow F$
$F \rightarrow T$

Not true.
false ∀
∴ contingency.

p	q	$p \wedge \sim q$	$p \rightarrow q$
T	T	F ✓	T ✓
T	F	T ✓	F ✓
F	T	F ✓	T ✓
F	F	F ✓	T ✓

The expression

$\sim(p \rightarrow q) \rightarrow (p \wedge \sim q)$

$F \rightarrow F$
$T \rightarrow T$
$F \rightarrow F$
$F \rightarrow F$

∴ Always true.
Tautology.

p	q	$p \rightarrow q$	$\sim p \wedge q$
T	T	T ✓	F ✓
T	F	F ✓	F ✓
F	T	T ✓	T ✓
F	F	T ✓	F ✓

$\sim(\sim p \wedge q) \vee (p \rightarrow q)$

$T \vee T \Rightarrow T$
$T \vee F \Rightarrow T$
$F \vee T \Rightarrow T$
$T \vee T \Rightarrow T$

∴ Tautology

p	q	$\sim p \vee q$	$p \wedge q$
T	T	T ✓	T ✓
T	F	F ✓	F ✓
F	T	T ✓	F ✓
F	F	T ✓	F ✓

$(p \wedge q) \wedge \sim(\sim p \vee q)$

$T \wedge F \Rightarrow F$
$F \wedge T \Rightarrow F$
$F \wedge F \Rightarrow F$
$F \wedge F \Rightarrow F$

∴ Contradiction.