d) $X \wedge Y \rightarrow Z, X \leftrightarrow Y, Z \rightarrow Y \models X \leftrightarrow Z$

$F = \{X \wedge Y \rightarrow Z, X \leftrightarrow Y, Z \rightarrow Y, \neg(X \leftrightarrow Z)\}$

STEP	FORMULA	RULE
1	$\{X \wedge Y \rightarrow Z\}$	ASSUMPTION
2	$\{X \leftrightarrow Y\}$	ASSUMPTION
3	$\{Z \rightarrow Y\}$	ASSUMPTION
4	$\{\neg(X \leftrightarrow Z)\}$	ASSUMPTION
5	$\{X\}$	1,2-EXPANSION
6	$\{Y \rightarrow Z\}$	1,2-EXPANSION
7	$\{\neg Y, Z\}$	6. β-EXPANSION
8	$\{X \rightarrow Y\}$	2, BIIMPLICATION
9	$\{Y \rightarrow X\}$	2, BIIMPLICATION
10	$\{\neg X, Y\}$	8, β-EXPANSION
11	$\{\neg Y, X\}$	9. β-EXPANSION
12	$\{Y, \neg Z\}$	3, β-EXPANSION
13	$\{\neg(X \rightarrow Z)\}$	4, BIIMPLICATION
14	$\{\neg(Z \rightarrow X)\}$	4. BIIMPLICATION
15	$\{X\}$	13, 2. EXPANSION

16	$\xi 7 z 3$	13,2- FORMULA
17	$\xi z 3$	14,2- FORMULA
18	$\xi 7 x 3$	14,2- FORMULA
19	$\xi z, -7 z 3$	7,12 RESOLUTION
20	$\xi - 7 z 3$	19,16 RESOLUTION
21	$\perp$	20,17 RESOLUTION

THE SET HAS A CLOSED EXPANSION $\Rightarrow$ THE STATEMENT IS CORRECT

e) $X \to Y \vee Z, Y \leftrightarrow Z \models X \to Y \wedge Z$

$F = \{X \to Y \vee Z, Y \leftrightarrow Z, \neg(X \to Y \wedge Z)\}$

STEP	FORMULA	RULE
1	$\{X \to Y \vee Z\}$	ASSUMPTION
2	$\{Y \leftrightarrow Z\}$	ASSUMPTION
3	$\{\neg(X \to Y \wedge Z)\}$	ASSUMPTION
4	$\{\neg X, Y \vee Z\}$	1, β-EXPANSION
5	$\{\neg X, Y, Z\}$	4, β-EXPANSION
6	$\{Y \to Z\}$	2, BIIMPLICATION
7	$\{Z \to Y\}$	2. BIIMPLICATION
8	$\{\neg Y\}$	6, α-EXPANSION
9	$\{Z\}$	6, α-EXPANSION
10	$\{\neg Z\}$	7. α-EXPANSION
11	$\{Y\}$	8, α-EXPANSION
12	$\{X\}$	3, α-EXPANSION
13	$\{\neg(Y \wedge Z)\}$	3, α-EXPANSION
14	$\{\neg Y, \neg Z\}$	13, β-EXPANSION
15	$\{Y, Z\}$	5, 12 RESOLUTION