Check out A, B, C & D below.

A. Where ϕ and Ψ are any symbolic sentences, we say that ϕ ***logically implies*** Ψ (and we write $\phi \Rightarrow \Psi$) iff the conditional

$$(\phi \rightarrow \Psi)$$

is a theorem. This is the case iff the argument

$$\phi / \therefore \ \Psi$$

is valid.

B. We say that ϕ and Ψ are ***logically equivalent*** (and write $\phi \Leftrightarrow \Psi$) iff the biconditional

$$(\phi \leftrightarrow \Psi)$$

is a theorem. This is the case iff both $\phi \Rightarrow \Psi$ and $\Psi \Rightarrow \phi$;
i.e., iff both arguments

$\phi / \therefore \ \Psi$ and

$\Psi / \therefore \ \phi$

are valid.

C. Some logical equivalents to know.

1. $\sim(\phi \rightarrow \Psi) \Leftrightarrow (\phi \wedge \sim\Psi)$
2. $\sim(\phi \wedge \Psi) \Leftrightarrow (\sim\phi \vee \sim\Psi)$
3. $\sim(\phi \vee \Psi) \Leftrightarrow (\sim\phi \wedge \sim\Psi)$ (2 & 3 are the *De Morgan formulas*)
4. $\sim(\phi \leftrightarrow \Psi) \Leftrightarrow [(\phi \wedge \sim\Psi) \vee (\sim\phi \wedge \Psi)]$

5. $(\phi \vee \Psi) \Leftrightarrow (\sim\phi \rightarrow \Psi)$
6. $(\phi \rightarrow \Psi) \Leftrightarrow (\sim\phi \vee \Psi)$ (5 & 6 relate the conditional with disjunction)

7. $(\phi \wedge \Psi) \Leftrightarrow \sim(\phi \rightarrow \sim\Psi)$
8. $(\phi \rightarrow \Psi) \Leftrightarrow \sim(\phi \wedge \sim\Psi)$ (7 &8 relate the conditional with conjunction)

9. $(\phi \leftrightarrow \Psi) \Leftrightarrow (\phi \wedge \Psi) \vee (\sim\phi \wedge \sim\Psi)$
10. $(\phi \rightarrow \Psi) \Leftrightarrow (\sim\Psi \rightarrow \sim\phi)$ (law of contraposition)

D. The argument

$$\phi_1, \phi_2, ..., \phi_n / \therefore \Psi$$

is valid iff the conjunction $(\phi_1 \wedge \phi_2 \wedge ... \wedge \phi_n)$ of the premises logically implies the conclusion; i.e., iff the sentence

$$(\phi_1 \wedge \phi_2 \wedge ... \wedge \phi_n) \rightarrow \Psi$$

is a theorem.