(i) Given

(1) $p \wedge q$

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

(3) $s \rightarrow r$

$\therefore \sim s$

Solution:

1- $p \wedge q$	1st hypothesis(premise)
2- p	Inf. (1) Properties of $\wedge$
3- q	Inf. (1) Properties of $\wedge$
4- $p \rightarrow \sim (q \wedge r)$	2nd hypothesis(premise)
5- $\sim (q \wedge r)$	Inf. (2),(4)
6- $\sim q \vee \sim r$	De Morgan's Law on (5)
7- $\sim r$	Inf. (3),(6) and Domination Laws
8- $s \rightarrow r$	3rd hypothesis(premise)
9- $\sim r \rightarrow \sim s$	Contrapositive Law
10- $\sim s$	Inf. (7),(9)

(ii) Given

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

(2) $\sim p$

(3) $\sim r$

$\therefore q$

Solution:

1- $\sim (p \vee q) \rightarrow r$ 1st hypothesis(premise)

2- $\sim r$ 3rd hypothesis(premise)

3- $\sim r \rightarrow (p \vee q)$ Contrapositive Law and Double Negation Law

4- $p \vee q$ Inf. (2),(3)

5- $\sim p$ 2nd hypothesis(premise)

6- q Inf. (4),(5)

(iii) Given

(1) $\sim p \rightarrow (r \wedge s)$

(2) $p \rightarrow q$

(3) $\sim q$

$\therefore r$

Solution:

1- $p \rightarrow q$	2^{nd} hypothesis(premise)
2- $\sim q$	3^{rd} hypothesis(premise)
3- $\sim q \rightarrow \sim p$	Contrapositive Law on (1)
4- $\sim p$	Inf. (2),(3)
5- $\sim p \rightarrow (r \wedge s)$	1^{st} hypothesis(premise)
6- $r \wedge s$	Inf. (4),(5)
7- r	Inf. (6) Properties of $\wedge$

(iv) Given

(1) $p \rightarrow (\sim r \wedge \sim s)$

(2) $p \vee \sim q$

(3) s

$\therefore \sim q \wedge s$

Solution:

1- $p \rightarrow (\sim r \wedge \sim s)$ 1st hypothesis(premise)

2- $(r \vee s) \rightarrow \sim p$ Contrapositive Law on (1)

3- $p \vee \sim q$ 2nd hypothesis(premise)

4- $\sim p \rightarrow \sim q$ Implication Law on (3)

5- $(r \vee s) \rightarrow \sim q$ Inf. (2),(4)

6- s 3rd hypothesis(premise)

7- $r \vee s$ Inf. (6)

8- $\sim q$ Inf. (5),(7)

9- $\sim q \wedge s$ Inf. (6),(8)

(v) Given

(1) $p \vee q$

(2) $q \rightarrow r$

(3) $\sim r$

$\therefore p$

Solution:

1- $q \rightarrow r$	2nd hypothesis(premise)
2- $\sim r \rightarrow \sim q$	Contrapositive Law on (1)
3- $\sim r$	3rd hypothesis(premise)
4- $\sim q$	Inf. (2),(3)
5- $p \vee q$	1st hypothesis(premise)
6- $(p \vee q) \wedge \sim q$	Inf. (4),(5)
7- $(p \wedge \sim q) \vee (q \wedge \sim q)$	Distributive Law on (6)
8- $(p \wedge \sim q) \vee F$	Contradiction Law (7)
9- $(p \wedge \sim q)$	Identity Law on (8)
10- p	Inf. (9) properties of $\wedge$