

Solution 3

1.

$$\begin{aligned}
 \neg((\neg A \vee \neg B) \rightarrow (A \leftrightarrow C)) \rightarrow B &\equiv ((\neg A \vee \neg B) \rightarrow (A \leftrightarrow C)) \vee B \\
 &\equiv ((A \wedge B) \vee (A \leftrightarrow C)) \vee B \\
 &\equiv (A \wedge B) \vee (A \wedge C) \vee (\neg A \wedge \neg C) \vee B \\
 \neg((\neg A \vee \neg B) \rightarrow (A \leftrightarrow C)) \rightarrow B &\equiv ((\neg A \vee \neg B) \rightarrow (A \leftrightarrow C)) \vee B \\
 &\equiv ((A \wedge B) \vee (A \leftrightarrow C)) \vee B \\
 &\equiv (A \wedge B) \vee (A \wedge C) \vee (\neg A \wedge \neg C) \vee B \\
 &\equiv (A \wedge (A \vee C) \wedge (B \vee A) \wedge (B \vee C)) \vee ((\neg A \vee B) \wedge (\neg C \vee B)) \\
 &\equiv (A \vee B \vee \neg C) \wedge (\neg A \vee B \vee C)
 \end{aligned}$$

2.

$$\begin{aligned}
 \neg A \vee (A \wedge B) \vee C &\equiv (\neg A \vee B) \vee C \\
 &\equiv \neg A \vee B \vee C \\
 (\neg A \vee B) \wedge (B \vee C) &\equiv (\neg A \vee B \vee \neg C) \wedge (\neg A \vee B \vee C) \wedge (A \vee B \vee C)
 \end{aligned}$$

$$\text{So, } \neg A \vee (A \wedge B) \vee C \neq (\neg A \vee B) \wedge (B \vee C)$$

3. $(A \vee B) \wedge (A \rightarrow C) \wedge (B \rightarrow C)$

$$\begin{aligned}
 &\equiv (A \vee B) \wedge (\neg A \vee C) \wedge (\neg B \vee C) \\
 &\equiv (\neg A \wedge B \wedge C) \vee (A \wedge \neg B \wedge C) \vee (A \wedge B \wedge C)
 \end{aligned}$$

So, three solutions : $(A = 0, B = 1, C = 1), (A = 1, B = 0, C = 1), (A = 1, B = 1, C = 1)$

4.

$$(P \rightarrow (R \vee S)) \wedge (Q \rightarrow \neg R) \wedge (R \rightarrow \neg S) \equiv (\neg P \vee R \vee S) \wedge (\neg R \vee \neg S) \wedge (\neg R \vee \neg Q)$$

So, eight solutions : $(P, R), (P, S), (Q, S)$

5. $(A \rightarrow B) \wedge (B \vee C) \wedge (\neg B \vee \neg C) \wedge (C \leftrightarrow D) \wedge (D \vee E) \wedge (E \rightarrow (A \wedge B))$

$$\equiv (\neg A \vee B) \wedge (B \vee C) \wedge (\neg B \vee \neg C) \wedge (\neg C \vee D) \wedge (\neg D \vee C) \wedge (D \vee E) \wedge (\neg E \vee A) \wedge (\neg E \vee B)$$

So, two solutions : $(A, B, E), (C, D), (A, B)$