

2a) 8 points

1	1) C	A
2	2) $(D \rightarrow E)$	A
3	3) $(A \diamond B)$	A
1, 3	4) $(C \& (A \diamond B))$	1, 3 &I
1, 2, 3	5) $((D \rightarrow E) \& (C \& (A \diamond B)))$	2, 4 &I
1, 2, 3	6) $(C \& (A \diamond B))$	5 &E
1, 2, 3	7) $(A \diamond B)$	6 &E
1, 2, 3	8) $((A \rightarrow B) \& (B \rightarrow A))$	7 $\diamond$ E
1, 2, 3	9) $(A \rightarrow B)$	8 &E
1, 2	10) $((A \diamond B) \rightarrow (A \rightarrow B))$	3, 9 $\rightarrow$ I

*What you are supposed to do is to derive the conclusion from the two premises in the sequent. Hence if you have only derived the conclusion formula **without** its depending upon any premise (that is, you have only shown “ $\vdash ((A \diamond B) \rightarrow (A \rightarrow B))$ ”), 5 points will be deducted.

2b) 10 points

1	1) $\sim((\sim B \vee \sim C) \rightarrow A)$	A
2	2) $(A \vee (B \& C))$	A
3	3) $\sim A$	A
2, 3	4) $(B \& C)$	2, 3 $\vee$ E
2, 3	5) B	4 &E
6	6) $(\sim B \vee \sim C)$	A
7	7) $\sim B$	A
2, 3, 7	8) $(B \& \sim B)$	5, 7 &I
2, 3	9) $\sim \sim B$	7, 8 $\sim$ I
2, 3, 6	10) $\sim C$	6, 9 $\vee$ E
2, 3	11) C	4 &E
2, 3, 6	12) $(C \& \sim C)$	10, 11 &I
2, 6	13) A	3, 12 $\sim$ E
2	14) $((\sim B \vee \sim C) \rightarrow A)$	6, 13 $\rightarrow$ I
1, 2	15) $((\sim B \vee \sim C) \rightarrow A) \& \sim((\sim B \vee \sim C) \rightarrow A)$	1, 14 &I
1	16) $\sim(A \vee (B \& C))$	2, 15 $\sim$ I

c) 6 points

Not derivable

d) 8 points

1	1) $\sim((A \rightarrow B) \vee \sim B)$	A
2	2) A	A
3	3) B	A
3	4) $(A \rightarrow B)$	2, 3 $\rightarrow$ I
3	5) $((A \rightarrow B) \vee \sim B)$	4 $\vee$ I
1, 3	6) $((A \rightarrow B) \vee \sim B) \& \sim((A \rightarrow B) \vee \sim B)$	1, 5 $\&$ I
1	7) $\sim B$	3, 6 $\sim$ I
1	8) $((A \rightarrow B) \vee \sim B)$	7 $\vee$ I
1	9) $((A \rightarrow B) \vee \sim B) \& \sim((A \rightarrow B) \vee \sim B)$	1, 8 $\&$ I
	10) $((A \rightarrow B) \vee \sim B)$	1, 9 $\sim$ E

e) 8 points

1	1) $((A \rightarrow B) \rightarrow C)$	A
2	2) A	A
3	3) B	A
3	4) $(A \rightarrow B)$	2, 3 $\rightarrow$ I
1, 3	5) C	1, 4 $\rightarrow$ E
1	6) $(B \rightarrow C)$	3, 5 $\rightarrow$ I
1	7) $(A \rightarrow (B \rightarrow C))$	2, 7 $\rightarrow$ I