

3.3.xa. Exercise answers

1.

	$\neg (A \wedge \neg B)$	2
	A	(3)
	$\neg B$	(3)
3 Adj	A \wedge $\neg B$	X,(4)
	•	
4 QED	A \wedge $\neg B$	2
2 CR	\perp	1
1 IP	B	

2.

	$J \wedge \neg (J \wedge \neg C)$	1
1 Ext	J	(3),(6)
1 Ext	$\neg (J \wedge \neg C)$	5
	•	
3 QED	J	2
	$\neg C$	(6)
6 Adj	J \wedge $\neg C$	X,(7)
	•	
7 QED	J \wedge $\neg C$	5
5 CR	\perp	4
4 IP	C	2
2 Cnj	J \wedge C	

3.		$\neg(\neg(A \wedge B) \wedge C)$	2
		$\neg A$	(7)
		C	(4)
		<div style="display: flex; align-items: center;"> <div style="border-left: 1px solid black; padding-left: 5px; border-bottom: 1px solid black;">$A \wedge B$</div> <div style="margin-left: 5px;">6</div> </div>	
	6 Ext	A	(7)
	6 Ext	B	
		\bullet	
		\perp	5
	7 Nc	$\neg(A \wedge B)$	3
	5 RAA	$\neg(A \wedge B)$	3
		\bullet	
		C	3
	4 QED	C	3
	3 Cnj	$\neg(A \wedge B) \wedge C$	2
	2 CR	\perp	1
	1 RAA	$\neg C$	

4.		$\neg(A \wedge \neg(B \wedge C))$	3
		$A \wedge \neg B$	2
	2 Ext	A	(5)
	2 Ext	$\neg B$	(8)
		\bullet	
	5 QED	A	4
		$B \wedge C$	7
	7 Ext	B	(8)
	7 Ext	C	
		\bullet	
		\perp	6
	8 Nc	$\neg(B \wedge C)$	4
	6 RAA	$\neg(B \wedge C)$	4
		\bullet	
		$A \wedge \neg(B \wedge C)$	3
	4 Cnj	$A \wedge \neg(B \wedge C)$	3
	3 CR	\perp	1
	1 RAA	$\neg(A \wedge \neg(B \wedge C))$	

5.

		$\neg (A \wedge \neg B)$	3
		$\neg (B \wedge \neg C)$	7
		$A \wedge \neg C$	2
2 Ext		A	(5)
2 Ext		$\neg C$	(8)
		\bullet	
5 QED		A	4
		B	(8)
8 Adj		$B \wedge \neg C$	X,(9)
		\bullet	
9 QED		$B \wedge \neg C$	7
7 CR		\perp	6
6 RAA		$\neg B$	4
4 Cnj		$A \wedge \neg B$	3
3 CR		\perp	1
1 RAA		$\neg (A \wedge \neg C)$	

6.

		$\neg (A \wedge \neg B)$	3
		$\neg (A \wedge \neg C)$	7
		$A \wedge \neg (B \wedge C)$	2
2 Ext		A	(5),(9)
2 Ext		$\neg (B \wedge C)$	10
		•	
5 QED		A	4
		B	(11)
		•	
9 QED		A	8
		C	(11)
11 Adj		$B \wedge C$	X,(12)
		•	
12 QED		$B \wedge C$	10
10 CR		\perp	9
9 RAA		$\neg C$	8
8 Cnj		$A \wedge \neg C$	7
7 CR		\perp	6
6 RAA		$\neg B$	4
4 Cnj		$A \wedge \neg B$	3
3 CR		\perp	1
1 RAA		$\neg (A \wedge \neg (B \wedge C))$	

Choosing $\neg (B \wedge C)$ as the resource to exploit by CR at stage 3 would lead to a somewhat shorter and simpler derivation.