$\neg(A \leftrightarrow B) \vdash \neg A \leftrightarrow B.$

Apologies for not being able to show this during our tutorial! It's a little trickier than exam standard and (you'll see) harder the the other direction.

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1. $\neg(A \leftrightarrow B)$ given

show any $\hookrightarrow C$.

2. $\neg A$ ass.
3. $\neg B$ ass
4. A ass
5. $\bot$ $\bot I(2,4)$
6. B $\bot E(5)$
7. $A \to B$ $\to I(4,6)$
8. B ass
9. $\bot$ $\bot I(3,8)$
10. A $\bot E(9)$
11. $B \to A$ $\to I(8,10)$
12. $A \leftrightarrow B$ $\leftrightarrow I(7,11)$
13. $\bot$ $\bot I(1,12)$
14. B $PC(3,13)$
15. $\neg A \to B$ $\to I(2,14)$

I want to show
$\neg A \to B$
$B \to \neg A$
using $\to I$.

use PC. I don't have a good way to get B directly from $\neg(A \leftrightarrow B)$, $\neg A$. (*)

16. B ass
17. A ass
18. B ass
19. A $\surd(17)$
20. $B \to A$ $\to I(18,19)$
21. A ass
22. B $\surd(16)$
23. $A \to B$ $\to I(21,22)$
24. $A \leftrightarrow B$ $\leftrightarrow I(20,23)$
25. $\bot$ $\bot I(1,24)$
26. $\neg A$ $\neg I(17,25)$
27. $B \to \neg A$ $\to I(16,26)$
28. $\neg A \leftrightarrow B$ $\leftrightarrow I(15,27)$.

← almost the same strategy.

(*) This is because of all the $\neg$ symbols on the outside. The only way to remove $\neg$ is through contradiction. This is why I didn't use PC for the overall strategy (Think about this for 30 seconds).

$A \leftrightarrow \neg B \quad \vdash \neg(A \leftrightarrow B)$.

This is the easier one. ↑

This is of the form $\neg F$, so will try $\neg I$.

1.	$A \leftrightarrow \neg B$	given
2.	$A \leftrightarrow B$	ass.
3.	B	ass.
4.	A	$\leftrightarrow E(3,2)$
5.	$\neg B$	$\leftrightarrow E(4,1)$
6.	$\bot$	$\bot I(3,5)$
7.	$\neg B$	$\neg I(3,6)$
8.	A	$\leftrightarrow E(7,1)$
9.	B	$\leftrightarrow E(8,2)$
10.	$\bot$	$\neg E(9,7)$
11.	$\neg(A \leftrightarrow B)$	$\neg I(2,10)$

← deliberately being inconsistent here