Legend:

State markers:	Start 2 3
Main user visible content and interface:	Text, etc.
Auxiliary user visible content and interface:	Text, etc.
Pulldown menu:	option 1 option 2
Correct move:	
Incorrect move:	
Navigational move:	
Feedback content:	Text, etc.
Hint content:	Hint text, etc.

Start

Complete the following derivation by filling in the missing justification. To fill in the justification on a given line, just click anywhere on that line.

1.	¬P v ¬Q	Premise
2.	R → (P & Q)	Premise
3.	¬(P & Q)	?
4.	¬R	?
5.	¬R v ¬R	?
6.	R → ¬R	?

3 4 5 6

A B C D

Completed derivation:

1.	¬P v ¬Q	Premise
2.	R → (P & Q)	Premise
3.	¬(P & Q)	DeM: 1
4.	¬R	MT: 2, 3
5.	¬R v ¬R	Idem vI: 4
6.	R → ¬R	Def. → I: 5

A

Complete the correct justification for line 3 using the pull-down menus below to fill in the missing components.

`Comm &`
`Comm v`
`DeM`

:

1
2
3
4
5
6

`DeM`

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

`Comm &`

Commutativity is a property of conjunctions, not negated conjunctions.

`Comm v`

The rule `Comm v` can only be used to derive disjunctions, not negations.

1

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

2

There is no rule that allows the negation of the consequent of a conditional to be derived from the conditional.

3+

Only lines prior to the current line in the derivation can be cited as justification for a rule's application.

B

Complete the correct justification for line 4 using the pull-down menus below to fill in the missing components.

MT
HS
Exp →
Def →E

: 2,

1
2
3
4
5
6

MT

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

HS

HS does take two lines as jutification, but they must both be lines on which conditionals appear. There is only a single conditional prior to line 4 in the derivation, so HS couldn't be applied here.

Exp →

Exp → takes only a single line as justification, and can only be used to derive a conditional.

Def →E

Def →E takes only a single line as justification, and can only be used to derive a disjunction.

3

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

1

The formula on line 1 is neither a negation, nor a conditional, so it isn't of the right form to serve as the second line cited for any of the rules given.

2

The only rule that allows the same line to be cited twice is conjunction introduction.

4+

Only lines prior to the current line in the derivation can be cited as justification for a rule's application.

C

Complete the correct justification for line 5 using the pull-down menus below to fill in the missing components.

Idem &I
Idem &E
Idem vI
Idem vE

:

1
2
3
4
5
6

Idem vI → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

Idem &I → Idem &I can only be used to derive a conjunction.

Idem &E → Idem &E can only be applied to a conjunction that has the same formula as both conjuncts.

Idem vE → Idem vE can only be applied to a disjunction that has the same formula as both disjuncts.

4 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

1
2
3
→ Recall that the idempotence rules all add or remove copies of a given formula. The formula on the selected line is not a subformula of the formula on line 5, and the formula on line 5 isn't a subformula of it, so it couldn't be the correct line in this case.

5+ → Only lines prior to the current line in the derivation can be cited as justification for a rule's application.

D

Complete the correct justification for line 5 using the pull-down menus below to fill in the missing components.

Def → [I / E] : [1 / 2 / 3 / 4 / 5]

I → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

E → Def →E can only be used to derive a disjunction from a conditional.

5 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

1 → The conditional that is equivalent to the formula on line I is P → ¬Q.

2 → The disjunction that is equivalent to the formula on line I is ¬R v (P & Q).

3, 4 → The rules for the definition of the conditional can only be applied to disjunctions and conditionals (for the introduction and elimination rules, respectively).

Hint sequences by state:

A

Recall that commutativity is the property that belongs to a binary connective when the order of the two immediate subformulae doesn't make a difference to the truth-value of the formula, where DeMorgan's laws concern the relationships between disjunction, conjunction, and negation.

A negation couldn't possibly be derived using either of the commutativity rules, since they can only be used to derive conjunctions and disjunctions.

$\neg P \vee \neg Q$ appears on line 1, and is a disjunction of negations, which can be transformed, via DeMorgan's into a negated conjunction.

B

Note that the justification here includes the citations of two lines. Not all of the rules listed as choices are applied to two lines.

Both `MT` and `HS` take two lines as justification. Recall that Modus Tollens is Latin for "the mood that denies", and the hypothetical syllogism deals with the transitivity of the conditional.

Since $\neg R$ isn't a conditional, we know that it could not have been derived using `HS`. It is also the negation of the antecedent of the conditional on line 2, the negation of whose consequent appears on line, making it possible to derive the formula using `MT` applied to these two lines.

C

Recall that "idem" is Latin for "the same thing", so all the idempotence rules deal with adding or removing copies of formulae from conjunctions and disjunctions. Looking at the main connective of a formula will be helpful in determining which rule would be used to derive it.

Since this formula is a disjunction, it would have to be derived either by one of the elimination variants, or by `Idem ∨ I`. Since this formula isn't a subformula of any other line in the derivation, we know that the elimination variants couldn't have been used in this case.

`Idem ∨ I` takes the formula on the line to which it is applied and creates a disjunction, with both disjuncts being the same - the original formula. Since each disjunct here is the formula ¬R, we know the rule must have been applied to line 4.

B

Recall the truth-conditions of the conditional in order to remember how the definition of the conditional rules work: a conditional is true just in case with its antecedent is false or its consequent is true.

Since the formula on this line is a conditional, we know it must have been derived using the introduction variant of the definition of the conditional rules, and that the formula on the line to which it is applied must be a disjunction.

We want to apply `Def → I` to the disjunction that has the negation of the antecedent as the left-hand disjunct and the consequent as the right-hand disjunct, which turns out to be the disjunction on line 5.