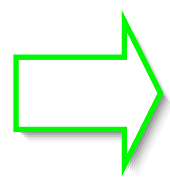
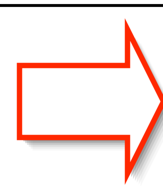
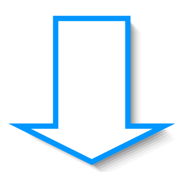
Legend:

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.	(∀x)(F(x) → G(x))	Premise
2.	(∀y)(G(y) → H(y))	Premise
3.	(∃x) F(x)	Premise
4.	(∀x)(G(x) → H(x))	?
5.	(∀x)(F(x) → H(x))	?
6.	(∃x)F(x) → (∃x)H(x)	?
7.	(∃x) H(x)	→E: 6, 3
8.	¬(∀x)¬H(x)	?

4 5 6 8

A B C D

Completed derivation:

1.	(∀x)(F(x) → G(x))	Premise
2.	(∀y)(G(y) → H(y))	Premise
3.	(∃x) F(x)	Premise
4.	(∀x)(G(x) → H(x))	RBV: 2
5.	(∀x)(F(x) → H(x))	∀HS: 1, 4
6.	(∃x)F(x) → (∃x)H(x)	∀→∃: 5
7.	(∃x) H(x)	→E: 6, 3
8.	¬(∀x)¬H(x)	Def. ∃E: 7

A

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

RBV
∀→
∀∀

:

1
2
3

RBV

answered only this

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

answered both

That's right.

∀→

The rule ∀→ can only be used to derive conditionals.

∀∀

Recall that ∀∀ is one of the multiple quantifier rules, used to change the order of two adjacent universal quantifiers.

2

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 that line has the right general form, but take a closer look at the predicate letters to see that they don't correspond to those in the formula derived.

3

The formula on that line is an existential, and the formula derived is a universal. Given the rules listed, there's no way to get from an existential formula to a universal one in this case.

B

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

∀HS ∀MT Contra.	:	1, 2 1, 4 2, 1 4, 1

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

∀HS → answered both → That's right.

∀MT → The rule ∀MT is applied to a universally quantified conditional, and a universally quantified negation. There are no negations at all in the derivation to this point, so there's no way that ∀MT could be applied.

Contra → The rule Contra. is applied to a single line, not to two lines.

1, 4 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

1, 4 → answered both → That's right.

1, 2 / 2, 1 → The variables of quantification in the two formulae don't match, so they couldn't be used together for any of the listed rules that take two lines as justification..

4, 1 → You've got the right lines, but in the wrong order.

C

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

∀→ ∀→∃ ∃→	:	1 2 3 4 5

∀→∃

answered only this

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

answered both

That's right.

∀→

The rule ∀→ can only be used to derive a conditional that has universally quantified formulae as both antecedent and consequent.

∃→

The rule ∃→ can only be applied to an existentially quantified conditional, and there are no such formulae in this derivation.

5

answered only this

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

answered both

That's right.

2

The variable of quantification in that formula doesn't match that in the formula derived, so given the rules listed, it couldn't possibly serve as justification in this case.

1
4

That formula could justify an application of some of the listed rules, but check the predicate letters - they don't match those in the derived formula.

3

All of the listed rules must be applied to quantified conditionals of some sort.

D

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

Def. ∀ / Def. ∃ | I / E | : 7

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

answered both → That's right.

Def. ∀ → The rule Def. ∀ can only be applied to either a universally quantified formula, or a negated existentially quantified negation.

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

answered both → That's right.

I → The introduction variants of the quantifier definition rules produce a formula that is either universally quantified or existentially quantified, depending on the rule, not a negation.

Hint sequences by state:

A

Two formulae that are exactly alike, with the one exception of their variables of quantification, are equivalent.

Since it is always possible to eliminate a quantifier then immediately introduce it again using a new variable of quantification, we include a derived rule to just change the variable.

The rule that allows the variable of quantification to be changed or renamed is RBV, and in this case, we can apply it to line 2 to derive the current formula.

B

Don't forget about the transitivity of the conditional and the sentential derived rule HS.

Remember that for any variety of the hypothetical syllogism, sentential or predicate, the consequent of the first conditional must be the same as the antecedent of the second conditional.

Applying ∀HS to the universally quantified conditionals on lines 1 and 4 will produce the current universally quantified conditional.

C

Compare the quantifiers in the derived formula to those in the line to which the rule is applied.

Only one of the rules listed takes a universally quantified formula and transforms it into a conditional with existentially quantified antecedent and consequent.

Applying the rule $\forall\rightarrow\exists$ to the universally quantified conditional on line 5 allows the current conditional to be derived.

D

For the quantifier definition rules, if the derived formula is a negation, then a quantifier was eliminated. The quantifier in the derived formula is not the same as that in the premise formula.

Since the formula is a negated, we know it must have been an elimination version of the rule that was applied.

Since the outermost quantifier will always differ between the formula produced and that to which the rule was applied, we know it must have been the rule for the definition of the existential that was used.