Take the following q-valuation –

The domain is {Romeo, Juliet, Benedick, Beatrice}

Constants are assigned references as follows:

'm' ⇒ *Romeo*
'n' ⇒ *Juliet*

Predicates are assigned extensions as follows:

'F' ⇒ {Romeo, Benedick}
'G' ⇒ {Juliet, Beatrice}
'L' ⇒ {⟨Romeo, Juliet⟩, ⟨Juliet, Romeo⟩, ⟨Benedick, Beatrice⟩, ⟨Beatrice, Benedick⟩, ⟨Benedick, Benedick⟩}

Then what are the truth values of the following wffs?

1. ∃x Lmx

   True. '∃x Lmx' is true if for some object *o* in the domain, the pair of objects ⟨Romeo, *o*⟩ is in the extension of 'L', and that condition is satisfied.

2. ∀x Lxm

   False. '∀x Lmx' is true if for every object *o* in the domain, the pair of objects ⟨Romeo, *o*⟩ is in the extension of 'L', and that condition isn't satisfied.

3 (∃x Lmx ⊃ Lmn)

   True. '∃x Lmx' is true – see (1) – and 'Lmn' is true, so material conditional is true.

4. ∀x(Fx ≡ ¬Gx)

   True. '∀x(Fx ≡ ¬Gx)' is if every x-variant of our valuation makes '(Fx ≡ ¬Gx)' true; but an x-variant makes that true if, whatever object in the domain we assign to 'x' if it is in the extension of 'F' it isn't in the extension of 'G' and vice versa. And that condition holds.

5. ∀x(Gx ⊃ (Lxm ∨ ¬Lmx))

   True. '∀x(Gx ⊃ (Lxm ∨ ¬Lmx))' is if every x-variant makes '(Gx ⊃ (Lxm ∨ ¬Lmx))' true. The x-variants which assign Romeo or Benedick to 'x' make 'Gx' false so the conditional true. The x-variant which assign Juliet to 'x' makes 'Gx' true but also 'Lxm' true, so makes the conditional true. The x-variant which assign Beatrice to 'x' makes 'Gx' true but also '¬Lmx' true, so makes the conditional true. So every x-variant does indeed make '(Gx ⊃ (Lxm ∨ ¬Lmx))' true.

6. ∀x(Gx ⊃ ∃yLxy)

   True. '∀x(Gx ⊃ ∃yLxy)' is if every x-variant makes '(Gx ⊃ ∃yLxy)' true. The x-variants which assign Romeo or Benedick to 'x' make 'Gx' false so the conditional true. The x-variant which assign Juliet to 'x' makes 'Gx' true; but also '∃yLxy' true, since there is further extension of our valuation to give a y-variant which makes 'Lxy' true (namely the y-variant that assigns Romeo to 'y'). Likewise the x-variant which assign Beatrice to 'x' makes 'Gx' true; but also '∃yLxy' true, since there is further extension of our valuation to give a y-variant which makes 'Lxy' true (namely the y-variant that assigns Benedick to 'y'). So every x-variant does indeed make '(Gx ⊃ ∃yLxy)' true.

7. ∃x(Fx ∧ ∀y(Gy ⊃ Lxy))

   False. The x-variants which assign Juliet or Beatrice to 'x' make 'Fx' false so make the conjunction '(Fx ∧ ∀y(Gy ⊃ Lxy))' is false. The x-variant which assigns Romeo to 'x' makes the first conjunct true but makes the second conjunct false so '(Fx ∧ ∀y(Gy ⊃ Lxy))' is again false (for note, the second conjunt is true if further extension to give a y-variant makes

'(Gy ⊃ Lxy)' true, but the assignment of Beatrice to 'y' makes that conditional false). Similarly the x-variant which assigns Benedick to 'x' makes '(Fx ∧ ∀y(Gy ⊃ Lxy))' false again. So, no x-variant of our original valuation makes '(Fx ∧ ∀y(Gy ⊃ Lxy))' true.

Now take the following q-valuation –

The domain is {4, 7, 8, 11, 12}

Constants are assigned references as follows:

'm' ⇒ *7*
'n' ⇒ *12*

Predicates are assigned extensions as follows:

'F' ⇒ *the even numbers in the domain*
'G' ⇒ *the odd numbers in the domain*
'L' ⇒ *the set of pairs ⟨m, n⟩ where m and n are in the domain and m is less than n*

What are the truth values of the wffs (1) to (7) now?

1.	∃x Lmx	True
2.	∀x Lxm	False
3	(∃x Lmx ⊃ Lmn)	True
4.	∀x(Fx ≡ ¬Gx)	True
5.	∀x(Gx ⊃ (Lxm ∨ ¬Lmx))	False
6.	∀x(Gx ⊃ ∃yLxy)	True
7.	∃x(Fx ∧ ∀y(Gy ⊃ Lxy))	True