1. Write an argument in natural English (i.e. no symbolic notation) with 2 premises that is valid, not sound, and has a true conclusion. (3)

1 mark for each component correct

2. State a single limitation of **deductive** logic. (2)

Not inductive/abductive, so that means cannot go to broader conclusions. Is not ampliative. Does not generalize. Cannot handle probability. Doesn't reflect possibilities. We don't actually think deductively most of the time. Etc.

3. Can an inconsistent set of sentences contain a sentence that is a tautology? Explain your answer. (2)

Yes. A set of sentences is inconsistent iff there is no TVA that makes all the sentences true. So, if we have a set of two sentences, one being a contradiction and one being a tautology, then they will never be both true, and thus inconsistent.

Or any counterexample will do.

4. Consider the following argument:

> All contradictions are false.
> Any argument that has a false conclusion is invalid.
> Therefore, arguments with contradictory conclusions are invalid.

a. Is the argument valid? Circle your answer. (1)

VALID INVALID

b. Is the argument sound? Circle your answer and briefly explain your answer. (2)

SOUND NOT SOUND

c. Is the conclusion true or false? Circle your answer. (1)

TRUE FALSE

5. Are the following symbolic sentences official, informal, or not well-formed? Circle your answer. If it is official or informal, draw an arrow above the main-connective. If it is not well-formed, draw an arrow (or arrows) over the mistake (or mistakes) in the sentence.

a. (P∨Q)∧((R→S)↔(Z∨W)) OFFICIAL INFORMAL NOT WELL-FORMED (2)

b. (P→S)∨~W→T∨Z OFFICIAL INFORMAL NOT WELL-FORMED (2)

c. (~(P↔(Q∧~(S∧P)))) OFFICIAL INFORMAL NOT WELL-FORMED (2)

6. Provide two shortened truth-tables that demonstrates the following sentence is contingent. (3)

$$Q \vee S \rightarrow \sim(P \wedge \sim Q)$$

Makes it F:

P	Q	S
T	F	T

Pretty much anything else makes it T

7. Provide a shortened truth-table that demonstrates the following set of sentences is consistent. (3)

$$\{ P \leftrightarrow \sim Q \vee R,\ R \rightarrow \sim(S \vee W) \wedge \sim P,\ \sim(S \vee (Q \rightarrow W)) \}$$

P	Q	R	S	W
F	T	F	F	F

8. a. Provide a full truth-table for the following argument. (4)

P→R∨Q. ~Q↔P. ∴ R∧P.

P	Q	R	P	→	R	∨	Q	~	Q	↔	P	R	∧	P
T	T	T	T	T	T	T	T	F	T	F	T	T	T	T
T	T	F	T	T	F	T	T	F	T	F	T	F	F	T
T	F	T	T	T	T	T	F	T	F	T	T	T	T	T
T	F	F	T	F	F	F	F	T	F	T	T	F	F	T
F	T	T	F	T	T	T	T	F	T	T	F	T	F	F
F	T	F	F	T	F	T	T	F	T	T	F	F	F	F
F	F	T	F	T	T	T	F	T	F	F	F	T	F	F
F	F	F	F	T	F	F	F	T	F	F	F	F	F	F

b. Is the argument valid or invalid? Circle your answer and briefly explain how you know. (1)

VALID INVALID

There is at least one row where both premises are T but the conclusion is F. All or nothing mark here

For questions 9-12, symbolize the English sentence using the abbreviation scheme provided for each question.

9. Passing the written test is required for booking a driving test and getting a driver's license. (2)

P: One has passed the written test. Q: One books a driving test.

R: One gets a driver's license.

Q∧R→P

1 mark for P→Q∧R

10. Assuming neither Tim nor Jane like sports, their kids won't either. (3)

W: Tim likes sports. X: Jane likes sports. Z: Tim and Jane's kids like sports.

~(W∨X) → ~Z

~W∧~X

11. Unless it rains tomorrow, Joe will go for a jog only if not both Chris and Laura do too. (3)
P: Joe will go for a jog. Q: Chris will go for a jog. R: Laura will go for a jog.
S: It rains tomorrow.

$S \vee (P \rightarrow \sim(Q \wedge R))$
$\sim Q \vee \sim R$

Can do a form of $\sim\varphi \rightarrow \psi$ for unless

12. At least one of Avery, Lucy, or Mia being late is a necessary and sufficient condition for at most two of them getting in trouble. (3)
P: Avery will be late. Q: Lucy will be late. R: Mia will be late.
X: Avery will get in trouble. Y: Lucy will get in trouble. Z: Mia will get in trouble.

$P \vee Q \vee R \leftrightarrow \sim(X \wedge Y \wedge Z)$

13. Translate the following symbolic sentence into IDIOMATIC English using the abbreviation scheme provided. (3)

$$\sim(P \leftrightarrow Q) \rightarrow (X \wedge Z) \vee (Z \wedge Y) \vee (Y \wedge X)$$

P: Jenny quits her job. Q: Jenny buys a car. X: Danny will be happy.
Y: Nikki will be happy. Z: Leslie will be happy.

If Jenny quits her job or buys a car, but not both, then at least two of Danny, Nikki and Leslie will be happy.

The antecedent is exclusive or. They can make it explicit by saying P or Q but not both, but if they just use OR on its own they lose a ½ mark.