

Answers to Logic Questions

1. (a) Award (A1) each for any two of the following:

Good music students go to good universities.

Good mathematics students get good jobs.

Good music students get good jobs.

(A2)

- (b) (i) There is a good music student who is not a good mathematics student.

(A1)

- (ii) Good mathematics students go to good universities and students who go to good universities get good jobs.

(A1)

OR

Good mathematics students get good jobs.

(A1)

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2. (a) (i) $\neg(p \vee q)$ alternatively $\neg p \wedge \neg q$

(A1)

- (ii) $\neg(p \wedge q)$ alternatively $\neg p \vee \neg q$

(A1)

- (b)

p	q	$\neg p$	$\neg p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

(A2)

Note: Award (A1) for each bold column.

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3. (a) (i) “The food supply is adequate and the visitors are hungry but the oven is not working,” (or equivalent statement). (A2)
- (ii) “Either the oven is working and the food supply is adequate or the visitors are not hungry,” (or equivalent statement). (A2) 4

- (b) $(p \wedge q) \Rightarrow (p \vee q)$ (A2) 2
- Notes: Award (A1) for $(p \wedge q)$ and $(p \vee q)$, (A1) for \Rightarrow .*

(c)

p	q	$(p \wedge q)$	$(p \vee q)$	$(p \wedge q) \Rightarrow (p \vee q)$
T	T	T	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	T

(A2)

Therefore, $(p \wedge q) \Rightarrow (p \vee q)$ is a tautology (R1) 3

Notes: Follow through from part (ii) (b).

Award [$\frac{1}{2}$ mark] for each correct bold column and round up.

Award (R1) for a correct conclusion based on truth values in column headed $(p \wedge q) \Rightarrow (p \vee q)$.

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4. (a) and (b)

1	2	3	4	5	6
p	q	$p \wedge q$	$\neg p$	$p \vee q$	$(p \vee q) \wedge (\neg p \wedge \neg q)$
T	T	T	F	T	F
T	F	F	F	T (A1)	F
F	T	F	T	T	F
F	F	(T) (A2)	(F) (A2)	F (A1)	F

(C6)

- (c) The last column is a *contradiction*. (A2) (C2)

[8]

5. (a)

p	q	$p \Leftrightarrow q$	$(p \Leftrightarrow q) \wedge p$	$[(p \Leftrightarrow q) \wedge p] \Rightarrow q$
T	T	T	T	T
T	F	F	F	T
F	T	F	F	T
F	F	T	F	T

(A3)

Note: Award (A1) for each completely correct bold column.

(b) It is a tautology (or equivalent). The statement is valid.

(A1)

[4]

6. (a) Either Sean is at school or Sean is playing a game on his computer but not both.

(A1)(A1)

Note: (A1) for 'either ... or but not both' (A1) for correct statements. 'Either' can be omitted.

(C2)

(b) If Sean is not playing a game on his computer then Sean is at school.

(A1)(A1)

Note: (A1) for 'If ... then' (A1) for correct propositions in the correct order.

(C2)

(c)

$\neg q$	$p \Rightarrow \neg q$
F	F
T	T
F	T
T	T

(A1)(A1)(ft)

Note: (A1) for each correct column.

(C2)

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7. (a) (i) $\neg q \Rightarrow \neg p$ (A1)
(ii) $q \Rightarrow (p \vee r)$ (A2) 3

Note: Award (A1) for $q \Rightarrow$ and (A1) for $(p \vee r)$ with the parentheses.

- (b) If Alex does not play the flute then it is not true that he is a scientist or from Uruguay.

OR

If Alex does not play the flute then he is neither a scientist nor from Uruguay.

(A3) 3

Note: Award (A1) if then correct, (A1) if antecedent correct, (A1) if consequent correct.

(c)

$q \vee p$	$\neg(q \vee p)$	$\neg r \Rightarrow \neg(q \vee p)$
T	F	T
T	F	F
T	F	T
T	F	F
T	F	T
T	F	F
F	T	T
F	T	T
(A1)	(A1)	(A1)

(A3)

Not a logically valid argument.

(A1) 4

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8. (a) (i) $p \Rightarrow q$ (A1)
(ii) $r \vee \neg q$ (A1) 2

- (b) $p \Rightarrow q, r \vee \neg q$
 $\neg r$

(A1)

Therefore, $\neg p$

(A1)

OR

$\{(p \Rightarrow q) \wedge (r \vee \neg q) \wedge \neg r\} \Rightarrow \neg p$

(A2) 2

[4]