

Logic Practice

Question 1

Consider the following statements:

p : It is snowing. q : I wear a hat.

r : The boys will walk to school.

a. Translate each of the following symbolic statements into words.

i. $p \Leftrightarrow \neg q$ ii. $\neg p \wedge r$

b. Write the negation of the following statement:

He sees and he runs.

c. Write a symbolic statement that is logically equivalent to $\neg p \Rightarrow q$ without using " $\neg p$ ".

(a) (i) _____

(ii) _____

(b) _____

(c) _____

Question 3

a. Determine whether each of the following statements are true or false. Write the appropriate word in the answer space below.

i. $(-3 \leq 7) \vee 5$ is a prime number

ii. $(0 > 8) \Rightarrow 9$ is an odd number

iii. $(-1 \geq 6) \Leftrightarrow (3 + 4 \neq 7)$

b. Complete the following truth table:

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



Question 2

a. Consider the following conditional statement:

"If $x = 5$, then $x^2 = 25$."

(i) Write the converse of this statement.

(ii) Is this converse true? (yes or no)

(iii) Write the contrapositive of this statement.

(iv) Is this contrapositive logically equivalent to the original statement? (yes or no)

b. Determine whether each of the following is true or false. Write the appropriate word in the answer space below.

(i) The negation of $p \Rightarrow \neg q$ is $p \wedge q$.

(ii) The negation of $p \vee q$ is $\neg p \vee \neg q$.

Working.....

(a) (i) _____

(ii) Yes No
circle one

(iii) _____

(iv) Yes No
circle one

(b) (i) _____

(ii) _____

(6 marks)

Question 5

Consider the following statements:

- p : He plays the game.
- q : He hates to lose.
- r : We can party after the game.

- a. Write the following statement in words: $(p \wedge q) \Rightarrow \neg r$
- b. Complete the following truth table for the symbolic statement shown in part (a).

p	q	r	$\neg r$	$p \wedge q$	$(p \wedge q) \Rightarrow \neg r$
T	T	T			
T	T	F			
T	F	T			
T	F	F			
F	T	T			
F	T	F			
F	F	T			
F	F	F			

Working.....

(a) _____

(b) Write truth values in the table shown above.

(6 marks)

Question 6

a. Write the inverse of the following statement:

"If it is Tuesday, then Marie plays the violin."

b. (i) Complete the following truth table for $(p \Rightarrow q) \Rightarrow (\neg p \vee q)$.

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

(ii) Is $(p \Rightarrow q) \Rightarrow (\neg p \vee q)$ a tautology? Explain.

Working.....

(a) _____

(b) (i) Write truth values in the table shown above.

(ii) _____

(6 marks)

Question 7

a. Complete the truth table shown below:

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

b. Are the statements $p \wedge \neg q$ and $\neg q \Rightarrow \neg p$ logically equivalent? Explain.

Working

(a) Write truth values in the table shown above.

(b) _____

(6 marks)

Question 8

a. Consider the following statements p and q :

p : Mia cannot speak Spanish.

q : Johan cannot pass Biology.

r : Luca will finish his Extended Essay.

Translate each of the following statements into symbols.

(i) Mia can speak Spanish if and only if Luca will finish his Extended Essay. [2 marks]

(ii) If Johan can pass Biology, then Mia can speak Spanish and Luca will not finish his Extended Essay. [3 marks]

b. (i) Copy and complete the truth table for $(p \wedge q) \Rightarrow r$: [2 marks]

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

(ii) question continued on next page ...

b. (ii) Copy and complete the truth table for $(p \wedge q) \vee \neg r$: [2 marks]

p	q	r	$\neg r$	$p \wedge q$	$(p \wedge q) \vee \neg r$
T	T	T	F		
T	T	F	T		
T	F	T	F		
T	F	F	T		
F	T	T	F		
F	T	F	T		
F	F	T	F		
F	F	F	T		

(iii) Is $(p \wedge q) \Rightarrow r \equiv (p \wedge q) \vee \neg r$? Explain. [3 marks]

(12 total marks)

