

1. Consider the two propositions p and q .

p : The sun is shining

q : I will go swimming

Write in words the compound propositions

(a) $p \Rightarrow q$;

(2)

(b) $\neg p \vee q$.

(2)

The truth table for these compound propositions is given below.

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

- (c) Complete the column for $\neg p$.

(1)

- (d) State the relationship between the compound propositions $p \Rightarrow q$ and $\neg p \vee q$.

(1)

(Total 6 marks)

2. Two logic propositions are given

p : Dany goes to the cinema

q : Dany studies for the test

- (a) Write in words the proposition

$$p \vee q.$$

- (b) Given the statement s : "If Dany goes to the cinema then Dany doesn't study for the test".

- (i) Write s in symbolic form.

- (ii) Write in symbolic form the contrapositive of part (b)(i).

(Total 6 marks)

3. Consider the following statements:

p : Good mathematics students go to good universities

q : Good music students are good mathematics students

r : Students who go to good universities get good jobs

(a) From these statements, write two **valid** conclusions.

(b) Write in words each of the following

(i) $\neg q$;

(ii) $p \wedge r$.

(Total 4 marks)

4. Three propositions are given as

p : It is snowing

q : The roads are open

r : We will go skiing

(a) Write the following compound statement in symbolic form.

“It is snowing and the roads are not open.”

(2)

(b) Write the following compound statement in words.

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

(3)

An incomplete truth table for the compound proposition $(\neg p \wedge q) \Rightarrow r$ is given below.

(c) Copy and complete the truth table **on your answer paper**.

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

(3)

(Total 8 marks)

5. Consider each of the following statements:

p : Alex is from Uruguay

q : Alex is a scientist

r : Alex plays the flute

(a) Write each of the following arguments in symbols:

(i) If Alex is not a scientist then he is not from Uruguay.

(ii) If Alex is a scientist, then he is either from Uruguay or plays the flute.

(3)

(b) Write the following argument in words:

$$\neg r \Rightarrow \neg (q \vee p)$$

(3)

(c) Construct a truth table for the argument in part (b) using the values below for p , q , r and $\neg r$. Test whether or not the argument is logically valid.

p	q	r	$\neg r$
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

(4)

(Total 10 marks)

6. Let $\mathcal{U} = \{x : 1 \leq x < 17, x \in \mathbb{N}\}$.

P , Q and R are the subsets of \mathcal{U} such that

$P = \{\text{multiples of four}\};$

$Q = \{\text{factors of 36}\};$

$R = \{\text{square numbers}\}.$

(a) List the elements of

(i) \mathcal{U}

(ii) $P \cap Q \cap R.$

(2)

(b) Describe in words the set $P \cup Q.$

(1)

(c) (i) Draw a Venn diagram to show the relationship between sets P , Q and $R.$

(2)

(ii) Write the elements of \mathcal{U} in the appropriate places on the Venn diagram.

(3)

(d) Let p , q and r be the statements

p : x is a multiple of four;

q : x is a factor of 36;

r : x is a square number.

(i) Write a sentence, in words, for the statement

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

(2)

(ii) Shade the region on your Venn diagram in part (c)(i) that represents $(p \vee r) \wedge \neg q$

(1)

(iii) (a) Use a truth table to determine the values of $(p \vee r) \wedge \neg q.$ Write the first three columns of your truth table in the following format.

p	q	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

(3)

(b) Write down one possible value of x for which $(p \vee r) \wedge \neg q$ is true.

(1)

(Total 15 marks)