**IB MATH STUDIES EXAM REVIEW: Topic 3**

**Logical Symbols, Truth Tables, Tautologies, Contradictions, Equivalences, Converse, Inverse, Contrapositive, Sets, Venn Diagrams, Probability, Tree Diagrams, Mutual Exclusivity, Independence, Conditional Probability**

**1.** (a) List the elements of the set *A* = {*x*│–4 ≤ *x* ≤ 2, *x* is an integer}.

(1)

A number is chosen at random from set *A.*

Write down the probability that the number chosen is

(b) a negative integer;

(2)

(c) a positive even integer;

(1)

(d) an odd integer less than –1.

(2)

(Total 6 marks)

**2.** Police in a town are investigating the theft of mobile phones one evening from three cafés, “Alan’s Diner”, “Sarah’s Snackbar” and “Pete’s Eats”.

They interviewed two suspects, Matthew and Anna about that evening.

Matthew said:

“I visited Pete’s Eats and visited Alan’s Diner and I did not visit Sarah’s Snackbar”

Let *p,* *q* and *r* be the statements:

*p* : I visited Alan’s Diner  
*q* : I visited Sarah’s Snackbar  
*r* : I visited Pete’s Eats

(a) Write down Matthew’s statement in symbolic logic form.

(3)

What Anna said was lost by the police, but in symbolic form it was

(*q*  ¬*p*

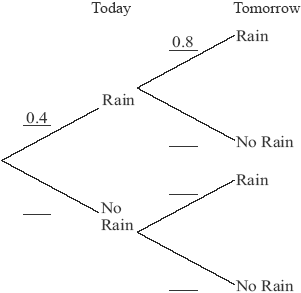
(b) Write down, in words, what Anna said.

(3)

(Total 6 marks)

**3.** The probability that it rains today is 0.4. If it rains today, the probability that it will rain tomorrow is 0.8. If it does not rain today, the probability that it will rain tomorrow is 0.7.

(a) Complete the tree diagram below.



(3)

(b) Calculate the probability of rain tomorrow.

(3)

(Total 6 marks)

**4.** *U* is the set of all the **positive** integers less than or equal to 12.  
*A,* *B* and *C* are subsets of *U.*

*A* = {1, 2, 3, 4, 6,12}  
*B* = {odd integers}  
*C* = {5, 6, 8}

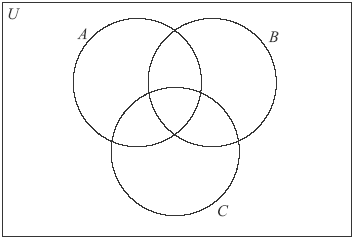
(a) Write down the number of elements in *A*  *C*.

(1)

(b) List the elements of *B.*

(1)

(c) Complete the following Venn diagram with **all** the elements of *U.*



(4)

(Total 6 marks)

**5.** In a particular school, students must choose at least one of three optional subjects: art, psychology or history.

Consider the following propositions

*a: I choose art,  
p: I choose psychology,  
h: I choose history.*

(a) Write, in words, the compound proposition

¬*h* .

(3)

(b) Complete the truth table for ¬*a*  *p*.

|  |  |  |  |
| --- | --- | --- | --- |
| *a* | *p* | ¬*a* | ¬*a*  *p* |
| T | T | F |  |
| T | F | F |  |
| F | T | T |  |
| F | F | T |  |

(1)

(c) State whether ¬*a*  *p* is a tautology, a contradiction **or** neither. Justify your answer.

(2)

(Total 6 marks)

**6.** A survey was carried out at an international airport. A number of travellers were interviewed and asked for their flight destinations. The results are shown in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Destination** | **America** | **Africa** | **Asia** |
| **Number of males** | 45 | 62 | 37 |
| **Number of females** | 35 | 46 | 25 |

One traveller is to be chosen at random from all those interviewed.

(a) Find the probability that this traveller was going to Africa.

(2)

One female traveller is to be chosen at random from all those interviewed.

(b) Find the probability that this female traveller was going to Asia.

(2)

One traveller is to be chosen at random from those **not** going to America.

(c) Find the probability that the chosen traveller is female.

(2)

(Total 6 marks)

**7.** One day the number of customers at three cafés, “Alan’s Diner” (*A*), “Sarah’s Snackbar” (*S*) and “Pete’s Eats” (*P*) was recorded and are given below.

17 were customers of Pete’s Eats only  
27 were customers of Sarah’s Snackbar only  
15 were customers of Alan’s Diner only  
10 were customers of Pete’s Eats **and** Sarah’s Snackbar **but not** Alan’s Diner  
8 were customers of Pete’s Eats **and** Alan’s Diner **but not** Sarah’s Snackbar

(a) Draw a Venn Diagram, using sets labelled *A,* *S* and *P,* that shows this information.

(3)

There were 48 customers of Pete’s Eats that day.

(b) Calculate the number of people who were customers of all three cafés.

(2)

There were 50 customers of Sarah’s Snackbar that day.

(c) Calculate the total number of people who were customers of Alan’s Diner.

(3)

(d) Write down the number of customers of Alan’s Diner that were also customers of Pete’s Eats.

(1)

(e) Find *n*[(*S*  *P*)  *A*′].

(2)

Some of the customers in each café were given survey forms to complete to find out if they were satisfied with the standard of service they received.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Pete’s Eats** | **Alan’s Diner** | **Sarah’s Snackbar** | **Total** |
| **Dissatisfied** | 16 | 8 | 16 | 40 |
| **Satisfied** | 26 | 20 | 34 | 80 |
| **Total** | 42 | 28 | 50 | 120 |

One of the survey forms was chosen at random, find the probability that

(f) the form showed “Dissatisfied”;

(2)

(g) the form showed “Satisfied” and was completed at Sarah’s Snackbar;

(2)

(h) the form showed “Dissatisfied”, given that it was completed at Alan’s Diner.

(2)

(Total 17 marks)

**8.** Two propositions *p* and *q* are defined as follows:

*p: the* *number* *ends* *in* *zero*

*q*: *the* *number* *is* *divisible* *by* *5*

(a) Write in words

(i) *p*  *q*;

(ii) the converse of (*p*  *q*).

(b) Write in symbolic form

(i) the inverse of (*p*  *q*);

(ii) the contrapositive of (*p*  *q*).

(Total 4 marks)