# Logic, Sets & Probability Marks

**1a.** *[1 mark]*

## Markscheme

I was not paid ***(A1)*** ***(C1)***

***[1 mark]***

 **1b.** *[1 mark]*

## Markscheme

 ***(A1)*** ***(C1)***

***[1 mark]***

 **1c.** *[2 marks]*

## Markscheme

 ***(A1)(A1)*** ***(C2)***

**Note:** Award ***(A1)*** for each correct column.

***[2 marks]***

 **1d.** *[2 marks]*

## Markscheme

yes ***(A1)*(ft)**

as the last two columns of the truth table are the same ***(R1)*(ft)** ***(C2)***

**Note:** Do not award ***(A1)(R0)****.* Follow through from part (c)(i).

***[2 marks]***

 **2a.** *[3 marks]*

## Markscheme

if the teacher is absent then the lesson is cancelled and the students are in the library ***(A1)(A1)(A1) (C3)***

**Note:** Award ***(A1)*** for If…then.
For Spanish candidates, only accept “Si” and “entonces”.
For French candidates, only accept “Si” and “alors”.
For all three languages these words are from the subject guide.
Award ***(A1)*** for “and”,
Award ***(A1)*** for correct propositions in correct order.

 **2b.** *[2 marks]*

## Markscheme



***(A1)(A1)*(ft) *(C2)***

Note: Award ***(A1)*** for  column correct and ***(A1)*** for  column correct.
Award ***(A0)(A1)*(ft)** for a  column that correctly follows from an incorrect  column.

 **2c.** *[1 mark]*

## Markscheme

not all of the entries are true (or equivalent) ***(R1) (C1)***

**Note:** Accept “One entry is false”.

 **3a.** *[2 marks]*

## Markscheme

If I do not break my arm, then it will not hurt ***(A1)(A1) (C2)***

**Note:** Award ***(A1)*** for “if… then…”

For Spanish candidates, **only** accept “Si” and “entonces”.

Award ***(A1)*** for “not break my arm” and “not hurt” in correct order.

 **3b.** *[2 marks]*

## Markscheme



***(A1)(A1) (C2)***

**Notes:**Award ***(A1)*** for each correct column.

 **3c.** *[2 marks]*

## Markscheme

logically equivalent ***(A1)*(ft)**

last two columns of the truth table are identical ***(R1)*(ft) *(C2)***

**Notes:** Do not award ***(A1)*(ft)*(R0)***.

Follow through from the last two columns of the table in part (a).

 **4a.** *[3 marks]*

## Markscheme

**If** the food is well cooked **and** the drinks are chilled **then** dinner is **not spoilt**. ***(A1)(A1)(A1) (C3)***

**Note:** Award ***(A1)*** for “If…then” (then must be seen), ***(A1)*** for the two correct propositions connected with “and”, ***(A1)*** for “not spoilt”.

 Only award the final ***(A1)*** if correct statements are given in the correct order.

***[3 marks]***

 **4b.** *[3 marks]*

## Markscheme *(A1)(A1)(A1)*(ft) *(C3)*

**Notes:** Award ***(A1)*** for each correct column.

 The final column must follow through from the previous two columns.

***[3 marks]***

 **5a.** *[3 marks]*

## Markscheme

(i)  ***(A1)(A1)***

**Note:** Award ***(A1)*** for conjunction, ***(A1)*** for negation of *q*.

(ii)  **OR**  ***(A1)*** ***(C3)***

 **5b.** *[3 marks]*

## Markscheme

If Yuiko is not studying Chinese, (then) she is studying French. ***(A1)(A1)(A1)*** ***(C3)***

**Notes:** Award ***(A1)*** for “if … (then)” seen, award ***(A1)*** for “not studying Chinese” seen, ***(A1)*** for correct propositions in correct order.

 **6a.** *[2 marks]*

## Markscheme

 ***(A1)(A1)*(ft)** ***(C2)***

**Notes:** Award ***(A1)*** for each correct column. Follow through in 4th column from their 3rd column.

***[2 marks]***

 **6b.** *[2 marks]*

## Markscheme

 ***(A1)(A1)*** ***(C2)***

**Note:** Award ***(A1)*** for  and *p* in any order, ***(A1)*** for .

***[2 marks]***

 **6c.** *[2 marks]*

## Markscheme

If I can swim 50 metres (then) I do not take swimming lessons. ***(A1)(A1)*** ***(C2)***

**Note:** Award ***(A1)*** for If… (then), ***(A1)*** for correct propositions in the correct order.

***[2 marks]***

 **7a.** *[4 marks]*

## Markscheme

 ***(A1)(A1)(A1)*(ft)*(A1)*(ft)** ***(C4)***

**Notes:** Award ***(A1)*** for each correct column.

 Award first ***(A1)*(ft)** from their third column in the table.

 Award second ***(A1)*(ft)** from their fourth and fifth column in the table.

***[4 marks]***

 **7b.** *[1 mark]*

## Markscheme

Tautology ***(A1)*(ft) *(C1)***

**Note:** Answer must be consistent with last column in table.

***[1 mark]***

 **7c.** *[1 mark]*

## Markscheme

All entries (in the final column) are true.***(R1)*(ft)*(C1)***

**Note:** Answer must be consistent with their answer to part (b)(i).

**Note:** Special case ***(A1)(R0)*** may be awarded.

***[1 mark]***

 **8a.** *[2 marks]*

## Markscheme

  ***(A1)(A1) (C2)***

**Note:** Award ***(A1)*** for ¬*q* , ***(A1)*** for last column.

***[2 marks]***

 **8b.** *[2 marks]*

## Markscheme

 ***(A1)(A1) (C2)***

**Note:** Award ***(A1)*** for  , ***(A1)*** for *p* and *q* in the correct order.

***[2 marks]***

 **8c.** *[2 marks]*

## Markscheme

If Cristina does not do well on the logic test then she does not understand logic. ***(A1)(A1)*** ***(C2)***

**Note:** Award ***(A1)*** for If…(then), must be an implication, ***(A1)*** for the correct propositions in the correct order.

***[2 marks]***

 **9a.** *[4 marks]*

## Markscheme

 ***(A1)(A1)*(ft)*(A1)(A1)*(ft) *(C4)***

**Note:** Award ***(A1)*** for each correct column (second column **(ft)** from first, fourth **(ft)** from third). Follow through from second column to fourth column for a consistent mistake in implication.

***[4 marks]***

 **9b.** *[2 marks]*

## Markscheme

Since second and fourth columns are not identical  ***(R1)*(ft)**
 Not a tautology  ***(A1)*(ft) *(C2)***

**Note: *(R0)(A1)*** may **not** be awarded.

***[2 marks]***

 **10a.** *[2 marks]*

## Markscheme

If a quadrilateral is not a square (then) the four sides of the quadrilateral are not equal. ***(A1)(A1)*** ***(C2)***

**Note:** Award ***(A1)*** for “if…(then)”, ***(A1)*** for the correct phrases in the correct order.

***[2 marks]***

 **10b.** *[2 marks]*

## Markscheme

If the four sides of the quadrilateral are equal (then) the quadrilateral is a square. ***(A1)(A1)*(ft)** ***(C2)***

**Note:** Award ***(A1)*** for “if…(then)”, ***(A1)*(ft)** for the correct phrases in the correct order.

**Note:** Follow through in (b) if the inverse and converse in (a) and (b) are correct and reversed.

***[2 marks]***

 **10c.** *[2 marks]*

## Markscheme

The converse is not always true, for example a rhombus (diamond) is a quadrilateral with four equal sides, but it is not a square. ***(A1)(R1)*** ***(C2)***

**Note:** Do not award ***(A1)(R0)***.

***[2 marks]***

 **11a.** *[4 marks]*

## Markscheme



***(A1)(A1)(A1)(A1)***

**Note:** Award ***(A1)*** for a rectangle with  intersecting clearly labelled circles.
Award ***(A1)*** for  in correct region.
Award ***(A1)*** for , ,  in correct regions.
Award ***(A1)*** for , ,  in correct regions.

 **11b.** *[6 marks]*

## Markscheme

(i)  ***(A1)*(ft)**

**Note:** Follow through from their Venn diagram.

(ii)  ***(A1)*(ft)**

**Note:** Follow through from their Venn diagram.

(iii)  ***(M1)***

 ***(A1)*(ft)*(G2)***

**Note:** Award ***(M1)*** for addition of their , ,  and . Follow through from their Venn diagram.

(iv)  ***(M1)***

**Note:** Award BI for their , or a sum adding to their , seen.

 ***(A1)*(ft)*(G2)***

**Note:** Follow through from their Venn diagram.

 **11c.** *[2 marks]*

## Markscheme

 ***(A1)*(ft)*(A1)(G2)***

**Note:** Award ***(A1)*(ft)** for correct numerator. Follow through from their Venn diagram.
Award ***(A1)*** for  in the denominator.

 **11d.** *[2 marks]*

## Markscheme

 ***(A1)*(ft)*(A1)*(ft)*(G2)***

**Note:** Award ***(A1)*(ft)** for correct numerator, ***(A1)*(ft)** for correct denominator. Follow through from their Venn diagram or numerator from part (c).

 **12a.** *[4 marks]*

## Markscheme

 ***(A1)(A1)(A1)(A1)***

**Note:** Award ***(A1)*** for rectangle and three labelled intersecting circles (the rectangle need not be labelled), ***(A1)*** for 5, ***(A1)*** for 2 and 1,***(A1)*** for 4, 3 and 9.

***[4 marks]***

 **12b.** *[2 marks]*

## Markscheme

 ***(M1)***

**Notes:** Award ***(M1)*** for their  seen even if total is greater than .

 Do not award ***(A1)*(ft)** if their total is greater than .

 ***(A1)*(ft)*(G2)***

***[2 marks]***

 **12c.** *[6 marks]*

## Markscheme

(i)  ***(A1)*(ft)*(A1)(G2)***

**Notes:** Award ***(A1)*(ft)** for numerator, ***(A1)*** for denominator.

 Follow through from Venn diagram.

(ii)  ***(A1)(A1)(G2)***

**Notes:** Award ***(A1)*** for numerator, ***(A1)*** for denominator.

 There is no follow through; all information is given.

(iii) ) ***(A1)(A1)*(ft)*(G2)***

**Notes:** Award ***(A1)*** for numerator, ***(A1)*(ft)** for denominator.

 Follow through from part (c)(ii) **only**.

***[6 marks]***

 **12d.** *[2 marks]*

## Markscheme

 ***(A1)(A1)*(ft)*(G2)***

**Notes:** Award ***(A1)*** for numerator, ***(A1)*(ft)** for denominator.

 Follow through from Venn diagram.

***[2 marks]***

 **13a.** *[2 marks]*

## Markscheme

(i) 3, 4, 5, 6, 7, 8, 9 ***(A1)***

(ii) 3, 4, 6, 8 ***(A1)*(ft)** ***(C2)***

**Notes:** Follow through from part (a)(i).

***[2 marks]***

 **13b.** *[3 marks]*

## Markscheme



***(A1)*(ft)** for their 3, 6
***(A1)*(ft)** for their 4, 8, 9
***(A1)*(ft)** for their 5, 7 ***(A1)*(ft)*(A1)*(ft)*(A1)*(ft)** ***(C3)***

**Note:** Follow through from their universal set and set B in part (a).

***[3 marks]***

 **13c.** *[1 mark]*

## Markscheme

2 ***(A1)*(ft)** ***(C1)***

**Note:** Follow through from their Venn diagram.

***[1 mark]***

 **14a.** *[1 mark]*

## Markscheme

 (one) ***(A1)*** ***(C1)***

**Note:** ,  or  earns no marks.

***[1 mark]***

 **14b.** *[1 mark]*

## Markscheme

, , , , ,  ***(A1)*** ***(C1)***

**Note:** Do not penalise if braces, parentheses or brackets are seen.

***[1 mark]***

 **14c.** *[4 marks]*

## Markscheme

 ***(A1)(A1)*(ft)*(A1)*(ft)*(A1)*(ft)** ***(C4)***

**Notes:** Award ***(A1)*** for the empty set  .

Award ***(A1)*(ft)** for the correct placement of , ,  and .

Award ***(A1)*(ft)** for the correct placement of , , , , , , .

Award ***(A1)*(ft)** for the correct placement of .

Follow through from part (b).

***[4 marks]***