1.3 Sets, Set Notation and Venn Diagrams: 30-minute Pack

Total Marks

AQA 8365 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 In a survey of 100 people, S, D and C are the sets of people who like swimming, diving and cycling respectively. 10 people like all three activities. The number who like exactly two of the three activities is 3 times the number who like all three. 25 people like swimming only, 20 like diving only, 15 like cycling only, and the remaining people like none of the three activities.

(a) Find the number of people who like exactly two of the three activities. **(1)**

.....

(b) Find the number of people who like none of the three activities. **(2)**

.....

(c) Given that a randomly chosen person from the survey likes at least two of the activities, find the probability that they like all three. **(3)**

.....

(Total for Question 1 is 6 marks)

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2 46 students were asked which of two clubs, A and B, they belong to. $x + 2$ belong to A only, x belong to both clubs, $2x + 3$ belong to B only, and 5 belong to neither. Form and solve an equation to find x.

(Total for Question 2 is 4 marks)

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3 n(E) = 47, n(A) = 19, n(B) = 22 and n(A intersect B) = 5. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 3 is 3 marks)

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4 n(A) = 29, n(B) = 24, n(C) = 28, n(A intersect B) = 13, n(A intersect C) = 15, n(B intersect C) = 12 and n(A intersect B intersect C) = 8. Work out the number of elements that are in A only.

(Total for Question 4 is 3 marks)

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5 21 students were asked which of two clubs, A and B, they belong to. x + 3 belong to A only, x belong to both clubs, 2x + 4 belong to B only, and 6 belong to neither. Form and solve an equation to find x.

(Total for Question 5 is 4 marks)

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6 E = {1, 2, 3, ..., 20}. A = {square numbers} and B = {multiples of 4}, taken from E. List the members of A union B.

(Total for Question 6 is 3 marks)

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7 The universal set is E = {1, 2, 3, ..., 20}. A is the set of even numbers in E. B is the set of multiples of 3 in E.

(a) List the elements of A intersect B. **(2)**

(b) Find n(A union B). **(1)**

(Total for Question 7 is 3 marks)

8 A and B are two sets, both subsets of a universal set E. Explain why n(A union B) = n(A) + n(B) - n(A intersect B).

(Total for Question 8 is 3 marks)

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Mark scheme · 1.3 Sets, Set Notation and Venn Diagrams: 30-minute Pack

Question 1

(a) 30 cao	**B1**
(a) Answer: 30	
(b) sums the known regions: 10 + 30 + 25 + 20 + 15 = 100	**M1**
(b) 0 cao	**A1**
(b) Answer: 0	
(c) finds the number who like at least two activities: 30 + 10 = 40	**M1**
(c) sets up the conditional probability as 10 / their 40	**M1**
(c) 1/4 cao	**A1**
(c) Answer: 1/4	

Question 2

(x + 2) + x + (2x + 3) + 5 = 46	**M1**
4x + 10 = 46 or equivalent	**M1**
4x = 36	**M1**
x = 9 cao	**A1**
Answer: x = 9	

Question 3

n(A union B) = 19 + 22 - 5	**M1**
36 found	**A1**
47 - 36 = 11 cao	**A1**
Answer: 11	

Question 4

subtracts the overlaps from n(A)	**M1**
adds back n(A intersect B intersect C) once	**M1**
9 cao	**A1**
Answer: 9	

Question 5

(x + 3) + x + (2x + 4) + 6 = 21	**M1**
4x + 13 = 21 or equivalent	**M1**
4x = 8	**M1**
x = 2 cao	**A1**
Answer: x = 2	

Question 6

lists the members of A or the members of B	**M1**
applies the set operation A union B	**M1**
{1, 4, 8, 9, 12, 16, 20} cao	**A1**
Answer: {1, 4, 8, 9, 12, 16, 20}	

Question 7

(a) identifies at least two even multiples of 3 in E	**M1**
(a) {6, 12, 18} cao (all three, no extras)	**A1**
(a) Answer: {6, 12, 18}	
(b) n(A union B) = 13 cao	**B1**
(b) Answer: 13	

Question 8

recognises that any element in both A and B is counted twice when n(A) and n(B) are added together	**B1**
explains that subtracting n(A intersect B) once removes exactly one of the two counts for each such element	**B1**
correct overall conclusion: every element of A union B is then counted exactly once, giving n(A union B) = n(A) + n(B) - n(A intersect B)	**B1**

Answer: n(A union B) = n(A) + n(B) - n(A intersect B), because elements in the overlap are double-counted by n(A) + n(B) and must be subtracted once

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