1.3 Sets, Set Notation and Venn Diagrams: Test Pack

AQA 8365 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which of the following correctly describes A intersect B, for two sets A and B?

- ☐ A) All elements in A or B, or both
- ☐ B) All elements that are in both A and B
- ☐ C) All elements in A but not in B
- ☐ D) All elements not in A

(Total for Question 1 is 1 mark)

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2 A set X has n elements. Show that X has 2^n subsets, illustrating your answer using a 3-element set.

(Total for Question 2 is 4 marks)

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3 E = {1, 2, 3, ..., 36}. A = {square numbers} and B = {multiples of 3}, taken from E. List the members of A intersect B'.

(Total for Question 3 is 3 marks)

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4 23 people were asked about tea and coffee. 12 of them chose tea, 16 chose coffee, and 3 chose neither. Work out how many people chose both.

(Total for Question 4 is 3 marks)

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5 43 students were asked which of two clubs, A and B, they belong to. x + 3 belong to A only, x belong to both clubs, 3x + 0 belong to B only, and 5 belong to neither. Form and solve an equation to find x.

(Total for Question 5 is 4 marks)

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6 The universal set is E = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. A = {2, 4, 6, 8, 10}. What is n(A)?

- ☐ A) 2
- ☐ B) 5
- ☐ C) 8
- ☐ D) 10

(Total for Question 6 is 1 mark)

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7 n(E) = 34, n(A) = 19, n(B) = 12 and n(A intersect B) = 2. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 7 is 3 marks)

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8 n(A) = 18, n(B) = 15, n(C) = 20, n(A intersect B) = 10, n(A intersect C) = 10, n(B intersect C) = 11 and n(A intersect B intersect C) = 7. Work out the number of elements that are in A only.

(Total for Question 8 is 3 marks)

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9 E = {1, 2, 3, ..., 20}. A = {multiples of 5} and B = {multiples of 3}, taken from E. List the members of (A union B)'.

(Total for Question 9 is 3 marks)

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10 E = {1, 2, 3, ..., 25}. A = {factors of 36} and B = {multiples of 3}, taken from E. List the members of A union B.

(Total for Question 10 is 3 marks)

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11 n(E) = 31, n(A) = 15, n(B) = 21 and n(A intersect B) = 7. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 11 is 3 marks)

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12 E = {a, b, c, d, e}. P = {a, c, e}. Q = {b, d}.

(a) State, giving a reason, whether P and Q are disjoint (mutually exclusive) sets. **(2)**

(b) List all the subsets of Q. **(2)**

(Total for Question 12 is 4 marks)

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13 E = {x : x is an integer, $1 \leq x \leq 15$}. C is the set of prime numbers in E. D is the set of factors of 12 in E.

(a) List the elements of C. **(1)**

(b) List the elements of C intersect D. **(2)**

(Total for Question 13 is 3 marks)

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14 50 people were asked whether they like tea (T) or coffee (Co). 20 people like tea only, x people like both tea and coffee, 3x people like coffee only, and 6 people like neither.

(a) Form an equation in x and solve it to find the value of x. **(3)**

.....

(b) Find n(T union Co). **(1)**

.....

(c) Find the probability that a randomly chosen person likes both tea and coffee. **(1)**

.....

(Total for Question 14 is 5 marks)

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15 In a survey of 200 people, 120 read newspaper X, 90 read newspaper Y, and 45 read both newspapers.

(a) Find the number of people who read newspaper X only. **(1)**

.....

(b) Find the number of people who read neither newspaper. **(2)**

.....

(c) A person is chosen at random. Find the probability that they read exactly one of the two newspapers. **(1)**

.....

(Total for Question 15 is 4 marks)

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16 The universal set is E = {1, 2, 3, 4, 5}. A = {1, 2}. B = {2, 3}. Determine whether (A union B)' = A' union B', justifying your answer.

(Total for Question 16 is 4 marks)

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Mark scheme · 1.3 Sets, Set Notation and Venn Diagrams: Test Pack

Question 1

B cao **B1**

Answer: B) All elements that are in both A and B

Question 2

recognises that for each element of X, there are exactly 2 choices when forming a subset: include it, or do not include it **M1**

explains that since the n elements each have 2 independent choices, the total number of subsets is 2 x 2 x ... x 2 (n times) = 2^n **M1**

correct general conclusion that X has 2^n subsets, including the empty set and X itself **A1**

correctly illustrates with a 3-element set, e.g. {p, q, r}, by listing all 8 subsets: {}, {p}, {q}, {r}, {p,q}, {p,r}, {q,r}, {p,q,r}, confirming $2^3 = 8$ **B1**

Answer: A set with n elements has 2^n subsets (shown, illustrated for n = 3 giving 8 subsets)

Question 3

lists the members of A or the members of B **M1**

applies the set operation A intersect B' **M1**

{1, 4, 16, 25} cao **A1**

Answer: {1, 4, 16, 25}

Question 4

23 - 3 = 20 chose at least one **M1**

12 + 16 - 20 **M1**

8 cao **A1**

Answer: 8

Question 5

(x + 3) + x + (3x + 0) + 5 = 43 **M1**

5x + 8 = 43 or equivalent **M1**

5x = 35 **M1**

x = 7 cao **A1**

Answer: x = 7

Question 6

B cao **B1**

Answer: B) 5

Question 7

n(A union B) = 19 + 12 - 2 **M1**

29 found **A1**

34 - 29 = 5 cao **A1**

Answer: 5

Question 8

subtracts the overlaps from n(A) **M1**

adds back n(A intersect B intersect C) once **M1**

5 cao **A1**

Answer: 5

Question 9

lists the members of A or the members of B **M1**

applies the set operation (A union B)' **M1**

{1, 2, 4, 7, 8, 11, 13, 14, 16, 17, 19} cao **A1**

Answer: {1, 2, 4, 7, 8, 11, 13, 14, 16, 17, 19}

Question 10

lists the members of A or the members of B **M1**

applies the set operation A union B **M1**

{1, 2, 3, 4, 6, 9, 12, 15, 18, 21, 24} cao **A1**

Answer: {1, 2, 3, 4, 6, 9, 12, 15, 18, 21, 24}

Question 11

n(A union B) = 15 + 21 - 7 **M1**

29 found **A1**

31 - 29 = 2 cao **A1**

Answer: 2

Question 12

(a) states that P and Q are disjoint (mutually exclusive) **B1**

(a) correct reason: P and Q have no elements in common, so P intersect Q is the empty set **B1**

(a) Answer: Disjoint, since P and Q share no elements

(b) lists at least 3 correct subsets **M1**

(b) all four subsets correct: {}, {b}, {d}, {b, d} **A1**

(b) Answer: {}, {b}, {d}, {b, d}

Question 13

(a) {2, 3, 5, 7, 11, 13} cao (all six, no extras; 1 is not prime) **B1**

(a) Answer: {2, 3, 5, 7, 11, 13}

(b) lists the factors of 12, {1, 2, 3, 4, 6, 12}, or otherwise attempts the intersection **M1**

(b) {2, 3} cao **A1**

(b) Answer: {2, 3}

Question 14

(a) forms the equation 20 + x + 3x + 6 = 50 **M1**

(a) simplifies correctly to 4x = 24 **M1**

(a) x = 6 cao **A1**

(a) Answer: x = 6

(b) 44 cao **B1**

(b) Answer: 44

(c) 3/25 cao (oe 0.12, 12%) **B1**

(c) Answer: 3/25

Question 15

(a) 75 cao **B1**

(a) Answer: 75

(b) finds n(X union Y) = 120 + 90 - 45 = 165 **M1**

(b) 35 cao **A1**

(b) Answer: 35

(c) 3/5 cao (oe 0.6, 60%) **B1**

(c) Answer: 3/5

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Question 16

correctly finds (A union B)' = {4, 5}, using A union B = {1, 2, 3}	**B1**
correctly finds A' = {3, 4, 5} and B' = {1, 4, 5}	**M1**
correctly finds A' union B' = {1, 3, 4, 5}	**M1**
correct conclusion: since {4,5} is not equal to {1,3,4,5}, (A union B)' is not equal to A' union B' in general, so the statement is false (the correct identity is (A union B)' = A' intersect B')	**A1**

Answer: False. (A union B)' = {4,5} but A' union B' = {1,3,4,5}, so they are not equal

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