1.3 Sets, Set Notation and Venn Diagrams: 2-hour Pack

AQA 8365 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 n(E) = 43, n(A) = 18, n(B) = 20 and n(A intersect B) = 5. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 1 is 3 marks)

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2 37 students were asked which of two clubs, A and B, they belong to. x + 1 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 E = {1, 2, 3, ..., 30}. A = {multiples of 6} and B = {multiples of 4}, taken from E. List the members of A union B.

(Total for Question 3 is 3 marks)

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4 $A = \{x : 9 < x \leq 20, x \text{ is an integer}\}$. $B = \{x : x \text{ is one of the prime numbers}\}$. List the members of A intersect B.

(Total for Question 4 is 3 marks)

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5 33 people were asked about football and hockey. 15 of them chose football, 16 chose hockey, and 8 chose neither. One person is picked at random. Work out the probability that they chose exactly one of the two.

(Total for Question 5 is 4 marks)

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6 n(E) = 53, n(A) = 25, n(B) = 25 and n(A intersect B) = 9. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 6 is 3 marks)

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7 n(A) = 22, n(B) = 22, n(C) = 24, n(A intersect B) = 13, n(A intersect C) = 12, n(B intersect C) = 11 and n(A intersect B intersect C) = 7. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 7 is 3 marks)

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8 $A = \{x : 6 < x \leq 19, x \text{ is an integer}\}$. $B = \{x : x \text{ is one of the odd numbers}\}$. List the members of A intersect B.

(Total for Question 8 is 3 marks)

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9 25 people were asked about drama and music. 17 of them chose drama, 9 chose music, and 3 chose neither. One person who chose drama is picked at random. Work out the probability that this person also chose music.

(Total for Question 9 is 4 marks)

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10 n(E) = 40, n(A) = 16, n(B) = 25 and n(A intersect B) = 7. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 10 is 3 marks)

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11 n(A) = 14, n(B) = 25, n(C) = 20, n(A intersect B) = 8, n(A intersect C) = 5, n(B intersect C) = 12 and n(A intersect B intersect C) = 3. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 11 is 3 marks)

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12 A = {x : 3 < x ≤ 17, x is an integer}. B = {x : x is one of the odd numbers}. List the members of A intersect B.

(Total for Question 12 is 3 marks)

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13 E = {1, 2, 3, ..., 25}. A = {multiples of 6} and B = {multiples of 4}, taken from E. List the members of A intersect B'.

(Total for Question 13 is 3 marks)

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14 n(E) = 22, n(A) = 15, n(B) = 5 and n(A intersect B) = 2. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 14 is 3 marks)

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15 43 people were asked about football and hockey. 21 of them chose football, 23 chose hockey, and 4 chose neither. Work out how many people chose both.

(Total for Question 15 is 3 marks)

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16 A = {x : 0 < x ≤ 11, x is an integer}. B = {x : x is one of the odd numbers}. List the members of A intersect B.

(Total for Question 16 is 3 marks)

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17 n(A) = 13, n(B) = 14, n(C) = 15, n(A intersect B) = 7, n(A intersect C) = 6, n(B intersect C) = 4 and n(A intersect B intersect C) = 3. Work out the number of elements that are in A only.

(Total for Question 17 is 3 marks)

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18 n(E) = 33, n(A) = 14, n(B) = 17 and n(A intersect B) = 9. Work out n((A union B)'), the number of elements in neither A nor B.

(Total for Question 18 is 3 marks)

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19 E = {1, 2, 3, ..., 30}. A = {factors of 36} and B = {multiples of 4}, taken from E. List the members of A' intersect B.

(Total for Question 19 is 3 marks)

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20 $A = \{x : 1 < x \leq 13, x \text{ is an integer}\}$. $B = \{x : x \text{ is one of the multiples of } 3\}$. List the members of A intersect B.

(Total for Question 20 is 3 marks)

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21 n(A) = 20, n(B) = 16, n(C) = 16, n(A intersect B) = 10, n(A intersect C) = 6, n(B intersect C) = 3 and n(A intersect B intersect C) = 1. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 21 is 3 marks)

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22 n(A) = 15, n(B) = 18, n(C) = 15, n(A intersect B) = 6, n(A intersect C) = 11, n(B intersect C) = 6 and n(A intersect B intersect C) = 3. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 22 is 3 marks)

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23 n(A) = 20, n(B) = 18, n(C) = 23, n(A intersect B) = 11, n(A intersect C) = 9, n(B intersect C) = 13 and n(A intersect B intersect C) = 8. Work out the number of elements that are in A only.

(Total for Question 23 is 3 marks)

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24 $A = \{x : 7 < x \leq 16, x \text{ is an integer}\}$. $B = \{x : x \text{ is one of the multiples of } 3\}$. List the members of A intersect B'.

(Total for Question 24 is 3 marks)

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25 $n(A) = 14$, $n(B) = 8$, $n(C) = 17$, $n(A \cap B) = 3$, $n(A \cap C) = 8$, $n(B \cap C) = 3$ and $n(A \cap B \cap C) = 1$. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 25 is 3 marks)

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26 $A = \{x : 5 < x \leq 15, x \text{ is an integer}\}$. $B = \{x : x \text{ is one of the multiples of } 3\}$. List the members of A intersect B'.

(Total for Question 26 is 3 marks)

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27 $n(A) = 20$, $n(B) = 24$, $n(C) = 23$, $n(A \cap B) = 10$, $n(A \cap C) = 11$, $n(B \cap C) = 11$ and $n(A \cap B \cap C) = 3$. Work out the number of elements that are in exactly one of the sets A, B and C.

(Total for Question 27 is 3 marks)

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28 n(A) = 21, n(B) = 30, n(C) = 17, n(A intersect B) = 15, n(A intersect C) = 8, n(B intersect C) = 14 and n(A intersect B intersect C) = 7. Work out n(A union B union C).

(Total for Question 28 is 3 marks)

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29 In a class of 45 students, every student studies at least one of Maths (M), Physics (P) and Chemistry (Ch). 5 students study all three subjects. 4 study Maths and Physics only. 3 study Maths and Chemistry only. 6 study Physics and Chemistry only. 10 study Maths only. 7 study Physics only. The rest study Chemistry only.

(a) Find the number of students who study Chemistry only. **(2)**

.....

(b) Find n(M). **(2)**

.....

(c) A student is chosen at random. Find the probability that the student studies exactly two of the three subjects. **(2)**

.....

(Total for Question 29 is 6 marks)

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30 E = {x : x is an integer, $-10 \leq x \leq 10$}. A = {x : $x^2 \leq 25$, x is in E}. B = {x : x is a multiple of 3, x is in E}.

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

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

(c) Find n(A'), where A' is the complement of A within E. **(1)**

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(Total for Question 30 is 5 marks)

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31 120 people were asked whether they read newspaper X or newspaper Y. The number who read only X is twice the number who read both. The number who read only Y is 10 more than the number who read both. 18 people read neither newspaper.

(a) Let b be the number of people who read both newspapers. Form an equation in b and solve it. **(3)**

.....

(b) Find n(X), the number of people who read newspaper X. **(2)**

.....

(c) Given that a randomly chosen person reads at least one of the two newspapers, find the probability that they read both. **(2)**

.....

(Total for Question 31 is 7 marks)

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Mark scheme · 1.3 Sets, Set Notation and Venn Diagrams: 2-hour Pack

Question 1

n(A union B) = 18 + 20 - 5	**M1**
33 found	**A1**
43 - 33 = 10 cao	**A1**

Answer: 10

Question 2

(x + 1) + x + (2x + 3) + 5 = 37	**M1**
4x + 9 = 37 or equivalent	**M1**
4x = 28	**M1**
x = 7 cao	**A1**

Answer: x = 7

Question 3

lists the members of A or the members of B	**M1**
applies the set operation A union B	**M1**
{4, 6, 8, 12, 16, 18, 20, 24, 28, 30} cao	**A1**

Answer: {4, 6, 8, 12, 16, 18, 20, 24, 28, 30}

Question 4

lists A: 10 to 20	**M1**
identifies the prime numbers in A	**M1**
{11, 13, 17, 19} cao	**A1**

Answer: {11, 13, 17, 19}

Question 5

finds the number choosing both	**M1**
9 + 10 found	**M1**
19/33 or equivalent	**A1**
19/33 cao	**A1**

Answer: 19/33

Question 6

n(A union B) = 25 + 25 - 9	**M1**
41 found	**A1**
53 - 41 = 12 cao	**A1**

Answer: 12

Question 7

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
17 cao	**A1**

Answer: 17

Question 8

lists A: 7 to 19	**M1**
identifies the odd numbers in A	**M1**
{7, 9, 11, 13, 15, 17, 19} cao	**A1**

Answer: {7, 9, 11, 13, 15, 17, 19}

Question 9

finds the number choosing both	**M1**
4 correct	**A1**
4/17 or equivalent	**M1**
4/17 cao	**A1**

Answer: 4/17

Question 10

n(A union B) = 16 + 25 - 7	**M1**
34 found	**A1**
40 - 34 = 6 cao	**A1**

Answer: 6

Question 11

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
18 cao	**A1**

Answer: 18

Question 12

lists A: 4 to 17	**M1**
identifies the odd numbers in A	**M1**
{5, 7, 9, 11, 13, 15, 17} cao	**A1**

Answer: {5, 7, 9, 11, 13, 15, 17}

Question 13

lists the members of A or the members of B	**M1**
applies the set operation A intersect B'	**M1**
{6, 18} cao	**A1**

Answer: {6, 18}

Question 14

n(A union B) = 15 + 5 - 2	**M1**
18 found	**A1**
22 - 18 = 4 cao	**A1**

Answer: 4

Question 15

43 - 4 = 39 chose at least one	**M1**
21 + 23 - 39	**M1**
5 cao	**A1**

Answer: 5

Question 16

lists A: 1 to 11	**M1**
identifies the odd numbers in A	**M1**
{1, 3, 5, 7, 9, 11} cao	**A1**

Answer: {1, 3, 5, 7, 9, 11}

Question 17

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

Answer: 3

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Question 18

n(A union B) = 14 + 17 - 9	**M1**
22 found	**A1**
33 - 22 = 11 cao	**A1**

Answer: 11

Question 19

lists the members of A or the members of B	**M1**
applies the set operation A' intersect B	**M1**
{8, 16, 20, 24, 28} cao	**A1**

Answer: {8, 16, 20, 24, 28}

Question 20

lists A: 2 to 13	**M1**
identifies the multiples of 3 in A	**M1**
{3, 6, 9, 12} cao	**A1**

Answer: {3, 6, 9, 12}

Question 21

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
17 cao	**A1**

Answer: 17

Question 22

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
11 cao	**A1**

Answer: 11

Question 23

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

Answer: 8

Question 24

lists A: 8 to 16	**M1**
identifies the multiples of 3 in A	**M1**
{8, 10, 11, 13, 14, 16} cao	**A1**

Answer: {8, 10, 11, 13, 14, 16}

Question 25

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
14 cao	**A1**

Answer: 14

Question 26

lists A: 6 to 15	**M1**
identifies the multiples of 3 in A	**M1**
{7, 8, 10, 11, 13, 14} cao	**A1**

Answer: {7, 8, 10, 11, 13, 14}

Question 27

finds at least one 'only' region correctly	**M1**
combines all three 'only' regions	**M1**
12 cao	**A1**

Answer: 12

Question 28

adds n(A), n(B), n(C)	**M1**
subtracts the three pairwise intersections	**M1**
38 cao	**A1**

Answer: 38

Question 29

(a) sums the six known regions, 5 + 4 + 3 + 6 + 10 + 7 = 35	**M1**
(a) 10 cao	**A1**

(a) Answer: 10 students

(b) sums the four regions that make up M: 10 + 4 + 3 + 5	**M1**
(b) n(M) = 22 cao	**A1**

(b) Answer: 22

(c) identifies and sums the three 'exactly two' regions, 4 + 3 + 6 = 13	**M1**
(c) 13/45 cao	**A1**

(c) Answer: 13/45

Question 30

(a) recognises $x^2 \leq 25$ means $-5 \leq x \leq 5$	**M1**
(a) {-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5} cao (all 11, no extras)	**A1**

(a) Answer: {-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5}

(b) identifies the multiples of 3 within their set A	**M1**
(b) {-3, 0, 3} cao	**A1**

(b) Answer: {-3, 0, 3}

(c) n(A') = 10 cao	**B1**

(c) Answer: 10

Question 31

(a) forms the equation 2b + b + (b + 10) + 18 = 120	**M1**
(a) simplifies correctly to 4b = 92	**M1**
(a) b = 23 cao	**A1**

(a) Answer: b = 23

(b) n(X) = their (2b) + their b	**M1**
(b) n(X) = 69 cao	**A1**

(b) Answer: 69

(c) finds the number who read at least one newspaper, 120 - 18 = 102	**M1**
(c) 23/102 cao	**A1**

(c) Answer: 23/102

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