Set notation: subsets and n(A)

Worked solutions

GCSE Maths topic practice

This topic online

1 $\mathscr{E}$ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}

A = {multiples of 3}

a. List the members of A.

b. Is $8 \in A$? Write yes or no.

c. Write down n(A).

(3 marks)

a) multiples of 3 up to 12

$A = \{3, 6, 9, 12\}$

b) 8 is not in the list

no

c) count the members

$n(A) = 4$

2 $\mathscr{E}$ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

S = {square numbers}

a. List the members of S.

b. List the members of S'.

c. Write down n(S').

(3 marks)

a) square numbers up to 10

$S = \{1, 4, 9\}$

b) everything in E that is not in S

$S' = \{2, 3, 5, 6, 7, 8, 10\}$

c) count them: 10 - 3

$n(S') = 7$

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.

3 $A = \{x : x \text{ is an integer and } 2 < x \leq 7\}$

$B = \{x : x^2 < 20, x \text{ is an integer}\}$

a. List the members of A.

b. List the members of B.

c. Find n($A \cap B$).

(3 marks)

a) more than 2, up to and including 7

$A = \{3, 4, 5, 6, 7\}$

b) $4^2 = 16 < 20$ but $5^2 = 25$, negatives too

$B = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$

c) in both

$A \cap B = \{3, 4\}$

$n(A \cap B) = 2$

4 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$P = \{\text{prime numbers}\}$

$V = \{\text{even numbers}\}$

a. List the members of $P \cap V$.

b. List the members of $P \cap V'$.

c. List the members of $(P \cup V)'$.

(3 marks)

$P = \{2, 3, 5, 7, 11\}$

$V = \{2, 4, 6, 8, 10, 12\}$

a) prime and even

$P \cap V = \{2\}$

b) prime and not even

$P \cap V' = \{3, 5, 7, 11\}$

c) not prime and not even

$P \cup V = \{2, 3, 4, 5, 6, 7, 8, 10, 11, 12\}$

$(P \cup V)' = \{1, 9\}$

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.

5 $S = \{3, 7, 9\}$

List all the subsets of S. Remember that $\emptyset$ and S itself are both subsets of S. (3 marks)

Go by size so none are missed

0 members: $\emptyset$

1 member: $\{3\}, \{7\}, \{9\}$

2 members: $\{3, 7\}, \{3, 9\}, \{7, 9\}$

3 members: $\{3, 7, 9\}$

check: $2^3 = 8$ subsets

$\emptyset, \{3\}, \{7\}, \{9\}, \{3, 7\}, \{3, 9\}, \{7, 9\}, \{3, 7, 9\}$

6 $\mathscr{E}$ = {integers from 1 to 20}

A = {multiples of 4}

B = {even numbers}

C = {prime numbers}

For each statement, write yes if it is true or no if it is false.

a. $A \subset B$

b. $A \cap C = \emptyset$

c. $C \subset B'$

(3 marks)

$A = \{4, 8, 12, 16, 20\}$

$C = \{2, 3, 5, 7, 11, 13, 17, 19\}$

a) every multiple of 4 is even

yes

b) no multiple of 4 is prime, nothing in common

yes

c) B' = odd numbers, but $2 \in C$ and 2 is even

no

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.

7 $\mathscr{E} = \{x : x \text{ is an integer and } 1 \leq x \leq 15\}$

$A = \{x : x \text{ is a multiple of } 3\}$

$B = \{x : x > 9\}$

a. Find n(A).

b. List the members of $A \cap B$.

c. Find n(A').

d. Find n($(A \cup B)'$). (4 marks)

$A = \{3, 6, 9, 12, 15\}$

$B = \{10, 11, 12, 13, 14, 15\}$

a)

$n(A) = 5$

b) in both

$A \cap B = \{12, 15\}$

c) 15 in E, take off the 5 in A

$n(A') = 15 - 5$

$n(A') = 10$

d) count the union, then take it off 15

$A \cup B = \{3, 6, 9, 10, 11, 12, 13, 14, 15\}$

$n((A \cup B)') = 15 - 9$

$n((A \cup B)') = 6$

8 There are 32 students in a Year 10 class.

F is the set of students who study French and S is the set of students who study Spanish.

n(F) = 19, n(S) = 14 and n($F \cap S$) = 8.

a. Work out n($F \cup S$).

b. Work out how many students study neither French nor Spanish. (3 marks)

a) the 8 in both were counted twice

$n(F \cup S) = 19 + 14 - 8$

$n(F \cup S) = 25$

b) neither = class - union

$n((F \cup S)') = 32 - 25$

7 students

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.

9 60 people were asked which parts of a leisure centre they used last week.

P is the set of people who used the pool and C is the set of people who used the climbing wall.

38 people used the pool, 29 people used the climbing wall and 9 people used neither.

a. Find n($P \cap C$).

b. Find n($P \cap C'$).

(4 marks)

a) take off the 9 who used neither

$n(P \cup C) = 60 - 9 = 51$

$n(P \cup C) = n(P) + n(C) - n(P \cap C)$

$51 = 38 + 29 - n(P \cap C)$

$n(P \cap C) = 67 - 51$

$\boxed{n(P \cap C) = 16}$

b) pool but not climbing wall

$n(P \cap C') = 38 - 16$

$\boxed{n(P \cap C') = 22}$

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.

10 $\mathscr{E} = \{x : x \text{ is an integer and } -5 \leq x \leq 5\}$

$A = \{x : x^2 \geq 10\}$

$B = \{x : 2x + 1 > 0\}$

$C = \{x : x^2 = 16\}$

a. List the members of A.

b. Find n(B).

c. List the members of $A \cap B'$.

d. Is $C \subset A$? Write yes or no.

(5 marks)

$E = \{-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$

a) $3^2 = 9$ too small, $4^2 = 16$ and $5^2 = 25$ work, negatives too

$A = \{-5, -4, 4, 5\}$

b) solve the inequality

$2x + 1 > 0$

$x > -\frac{1}{2}$

$B = \{0, 1, 2, 3, 4, 5\}$

$n(B) = 6$

c) in A and not in B

$B' = \{-5, -4, -3, -2, -1\}$

$A \cap B' = \{-5, -4\}$

d) $C = \{-4, 4\}$, both are in A

yes

Free for classroom and home use: print, photocopy and share. Not for resale or re-hosting.