Chapter 18: Sets

Starter 18  [page 345]

1 Andy is right.
2 Britney could be wrong: some children could write with both hands, so there might be fewer than 30 children in class 2.
3 Carlo could be wrong: some children may have other favourite sports, so there might be more than 30 children in class 3.
4 Donna could be wrong: some children might play neither the violin nor the piano, so there might be more than 30 children in class 2.

Exercise 18.1  [page 348]

1 a) \{21, 23, 25, 27, 29, 31\}
   b) 6
2 Multiples of 5 from 5 to 25 inclusive
3 a) \(A = \{2, 3, 4, 5, 6, 7\}\)
   b) \(B = \{6, 7, 8, 9, 10, 11\}\)
   c) \(C = \{21, 22, 23, 24, 25\}\)
4 a) 45 \(\not\epsilon\) \{multiples of 7\}
   b) 24 \(\epsilon\) \{factors of 144\}
   c) 2 \(\epsilon\) \{all prime numbers\}
5 Hardback fiction books belonging to John
6 a) The set of all whole numbers (integers)
   b) Empty set
7 a) (i) 16 (ii) 10
   b) Multiples of 15 between 1 and 50, i.e. \{15, 30, 45\}
8 a) Quadrilaterals have 4 sides, triangles have 3
   b) Equilateral triangles
   c) Squares and rhombuses
9 a) (i) 4 (ii) 4 (iii) 0
   b) Empty set
10 a) \{11, 12\}
   b) \(\{x: 5 \leq x \leq 20, \text{ where } x \text{ is an integer}\\}

Exercise 18.2  [page 352]

1
2
3 a) 3
4
5
6 a) \(P \cap Q \cap R\)
   b) 15
e) 6
7 a) \(P \cap Q \cap R\)
  b) Contains just the number 2
c) The empty set
8 a) \(10 + 12 + 9 - 26 = 5\) liked both
   b)
   c) 12
9 a) \(P \cap Q \cap R\)
b) 7
10 a) \(P \cap Q \cap R\)
   b) 7 + 2 + 2 + 4 + 10 + 4 + 8 = 37, and 50 - 37 = 13 but this is the number of people who do not use car, bus or bicycle. They could use other forms of transport (train, motorcycle etc) so Fred’s statement is not correct.
Exercise 18.3  (page 356)

1. a) \[
\begin{array}{c}
P \cap Q = \emptyset \\
\end{array}
\]

b) \[
\begin{array}{c}
P \cap Q = \emptyset \\
\end{array}
\]

2. a) \(\{2, 4, 6, 8, 10, 12, 14\}\)
b) \(\{\text{odd numbers from 1 to 15 inclusive}\}\)
c) \(\{2, 4, 8, 10, 14\}\)

3. a) \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

b) \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

c) \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

4. a) \(\{\text{consonants}\}\)
b) \(3\)

5. \[
\begin{array}{c}
P \cap Q \cap R = \emptyset \\
\end{array}
\]

6. a) \(\{1, 2, 3, 4, 5, 6, 8\}\)
b) \(\{2, 4, 6\}\)
c) \(8\)

7. \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

8. a) \(\{\text{counties in England without a coastline}\}\)
b) There is at least one English county beginning with the letter C that has a coastline (e.g. Cornwall)

9. \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

10. a) There are 20 multiples of 5 between 1 and 100 inclusive. There are 14 multiples of 7 between 1 and 100 inclusive.
b) Some multiples of 5 are also multiples of 7
c) \(\{35, 70\}\)

11. a) i) \(\{1, 3\}\) ii) \(\{1, 2, 3, 4, 5\}\)
b) The number 3 is an element of set A

Review Exercise 18  (page 357)

1. a) \(\{2, 4, 7, 8, 9, 10\}\)
b) \(\{5, 6\}\)

2. a) \(P \cap Q = \emptyset \) b) \(Q \subset P\)

3. a) 27 b) 5
c) 6
d) 62

4. a) \(\{3, 6, 9, 12, 15, 18, 21, 24, 27, 30\}\)
b) 7 is neither a member of A nor B, so it is not true
c) \(\{12, 24\}\)

5. \(\mathbb{E} = \{\text{whole numbers}\}\)

A = \{multiples of 2\}

B = \{multiples of 3\}

a), b) \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

6. a) \(\{1, 2, 3, 4, 5, 6, 8\}\)
b) \(\{2, 4, 6\}\)
c) 8

7. \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

8. a) \(\{\text{counties in England without a coastline}\}\)
b) There is at least one English county beginning with the letter C that has a coastline (e.g. Cornwall)

9. \[
\begin{array}{c}
A \cap B = \emptyset \\
\end{array}
\]

10. a) There are 20 multiples of 5 between 1 and 100 inclusive. There are 14 multiples of 7 between 1 and 100 inclusive.
b) Some multiples of 5 are also multiples of 7
c) \(\{35, 70\}\)

11. a) i) \(\{1, 3\}\) ii) \(\{1, 2, 3, 4, 5\}\)
b) The number 3 is an element of set A
13 a) i) \[ A \cap B \]
ii) \{5, 10, 15\} (or any other three numbers that are multiples of 5 but not 3)

b) i) \[ A \cap B \cap C \]
ii) \{15, 45, 75\} (or any other three multiples of 15 that are not multiples of 10)

Internet Challenge 18 (page 361)
1 Bertrand Arthur William Russell
2 18 May 1872
3 Trinity
4 Alfred North Whitehead
5 Sir Isaac Newton
6 1 + 1 = 2
7 Nobel Prize for Literature
8 CND (Campaign for Nuclear Disarmament)
9 Four
10 2 February 1970