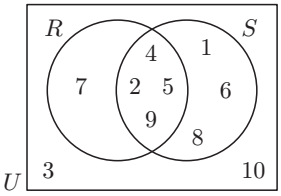
Chapter 7: Venn diagrams

7A VENN DIAGRAMS

A **Venn diagram** consists of a universal set U represented by a rectangle, and sets within it that are usually represented by circles.

1 Consider the Venn diagram alongside.



List the elements of:

a R **b** S

c $R \cup S$ **d** $R \cap S$

e R' **f** S'

g U

2 Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$. Draw a Venn diagram to represent:

a $A = \{2, 5, 7, 11\}$ and $B = \{1, 4, 6, 7, 8, 11\}$ **b** $A = \{1, 3, 4, 8, 9, 10, 12\}$ and $B = \{1, 4, 8, 10, 12\}$.

3 Suppose $U = \{x \in \mathbb{Z}^+ \mid x \leqslant 24\}$, $A = \{\text{factors of } 24\}$, and $B = \{\text{multiples of } 3\}$.

a List the elements of:

i A **ii** B

iii $A \cap B$ **iv** $A \cup B$

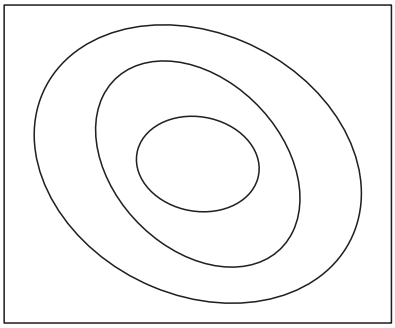
b Find:

i $n(A)$ **ii** $n(B)$ **iii** $n(A \cap B)$ **iv** $n(A \cup B)$

c Show that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.

d Illustrate A and B on a Venn diagram.

4 Consider the universal set $U = \mathbb{R}$.



a Label the sets $\mathbb{R}$, $\mathbb{Q}$, $\mathbb{Z}$, and $\mathbb{N}$ on the Venn diagram alongside.

b Place these numbers on the Venn diagram:

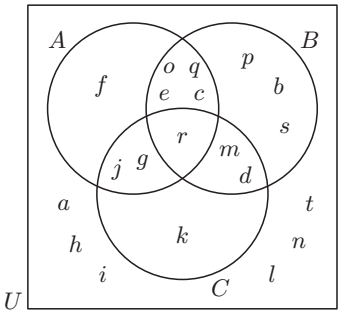
$\sqrt{10},\ -7,\ 5,\ \frac{4}{3},\ 0.\overline{1}$.

c Shade the region representing the set of negative integers $\mathbb{Z}^-$.

5 **a** List the elements of:

i A **ii** B

iii $A \cap C$ **iv** $A \cup B$



b Find:

i $n(B \cup C)$ **ii** $n(A' \cap B')$ **iii** $n(A \cap B \cap C)$

6 Suppose $U = \{x \in \mathbb{Z}^+ \mid x \leqslant 21\}$, $A = \{\text{prime numbers}\}$, $B = \{\text{multiples of } 7\}$, and $C = \{\text{factors of } 21\}$.

a Represent A, B, and C on a Venn diagram.

b List the elements which are in:

i both A and C **ii** C but not B

iii B and C but not A **iv** all of the sets

v none of the sets.