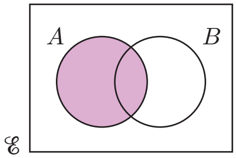
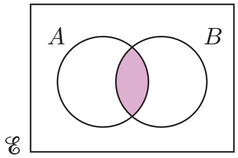
## USING VENN DIAGRAMS TO ILLUSTRATE REGIONS

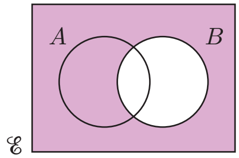
We can use shading to show various sets on a Venn diagram.
For example, for two intersecting sets $A$ and $B$:



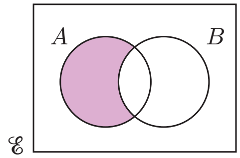
$A$ is shaded



$A \cap B$ is shaded



$B'$ is shaded



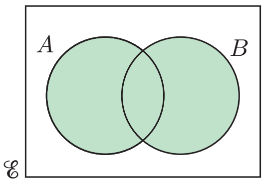
$A \cap B'$ is shaded

### Example 7 — Self Tutor

Shade the following regions for two intersecting sets $A$ and $B$:

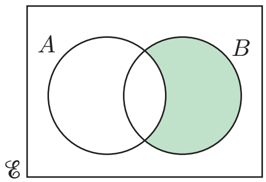
**a** $A \cup B$ **b** $A' \cap B$ **c** $(A \cap B)'$

**a**



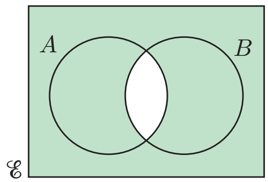
(in $A$, $B$, or both)

**b**



(outside $A$, intersected with $B$)

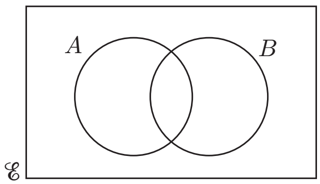
**c**



(outside $A \cap B$)

## EXERCISE 1F.2

**1**

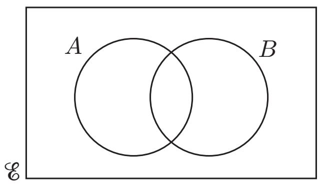



On separate Venn diagrams, shade regions for:

**a** $A \cap B$ **b** $A \cap B'$
**c** $A' \cup B$ **d** $A \cup B'$
**e** $A' \cap B$ **f** $A' \cap B'$

**PRINTABLE VENN DIAGRAMS (OVERLAPPING)**

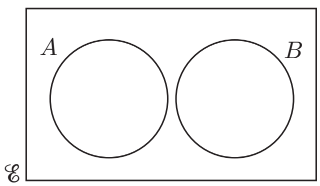
**2**




On separate Venn diagrams, shade regions for:

**a** $A \cup B$ **b** $(A \cup B)'$
**c** $(A \cap B)'$ **d** $A' \cup B'$
**e** $(A' \cup B')'$ **f** $(A \cup B')'$

**3**

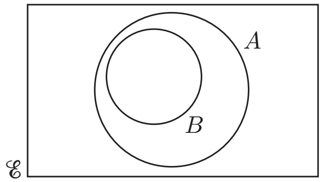



Suppose $A$ and $B$ are two disjoint sets. Shade on separate Venn diagrams:

**a** $A$ **b** $B$
**c** $A'$ **d** $B'$
**e** $A \cap B$ **f** $A \cup B$
**g** $A' \cap B$ **h** $A \cup B'$
**i** $(A \cap B)'$

**PRINTABLE VENN DIAGRAMS (DISJOINT)**

**4**

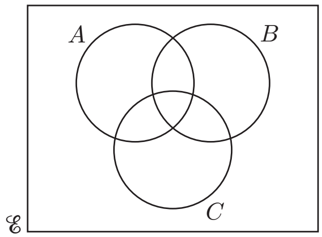



Suppose $B \subseteq A$, as shown in the given Venn diagram. Shade on separate Venn diagrams:

- **a** $A$
- **b** $B$
- **c** $A'$
- **d** $B'$
- **e** $A \cap B$
- **f** $A \cup B$
- **g** $A' \cap B$
- **h** $A \cup B'$
- **i** $(A \cap B)'$

**PRINTABLE VENN DIAGRAMS (SUBSET)**

**5**




This Venn diagram consists of three intersecting sets. Shade on separate Venn diagrams:

- **a** $A$
- **b** $B'$
- **c** $B \cap C$
- **d** $A \cup B$
- **e** $A \cap B \cap C$
- **f** $A \cup B \cup C$
- **g** $(A \cap B \cap C)'$
- **h** $(B \cap C) \cup A$
- **i** $(A \cup B) \cap C$
- **j** $(A \cap C) \cup (B \cap C)$
- **k** $(A \cap B) \cup C$
- **l** $(A \cup C) \cap (B \cup C)$

**PRINTABLE VENN DIAGRAMS (3 SETS)**

Click on the icon to practise shading regions representing various subsets. You can practise with both two and three intersecting sets.

**VENN DIAGRAMS**

## *Discovery* — *The algebra of sets*

For the set of real numbers $\mathbb{R}$, we can write laws for the operations $+$ and $\times$:

For any real numbers $a$, $b$, and $c$:

- **commutative** $a + b = b + a$ and $ab = ba$
- **identity** Identity elements 0 and 1 exist such that $a + 0 = 0 + a = a$ and $a \times 1 = 1 \times a = a$.
- **associativity** $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$
- **distributive** $a(b + c) = ab + ac$

The following are the **laws for the algebra of sets** under the operations $\cup$ and $\cap$:

For any subsets $A$, $B$, and $C$ of the universal set $\mathscr{E}$:

- **commutative** $A \cap B = B \cap A$ and $A \cup B = B \cup A$
- **associativity** $A \cap (B \cap C) = (A \cap B) \cap C$ and $A \cup (B \cup C) = (A \cup B) \cup C$
- **distributive** $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ and $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
- **identity** $A \cup \varnothing = A$ and $A \cap \mathscr{E} = A$
- **complement** $A \cup A' = \mathscr{E}$ and $A \cap A' = \varnothing$
- **domination** $A \cup \mathscr{E} = \mathscr{E}$ and $A \cap \varnothing = \varnothing$
- **idempotent** $A \cap A = A$ and $A \cup A = A$
- **DeMorgan's** $(A \cap B)' = A' \cup B'$ and $(A \cup B)' = A' \cap B'$
- **involution** $(A')' = A$