

Sets

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Worked example

From the Venn diagram below,
write in roster notation:

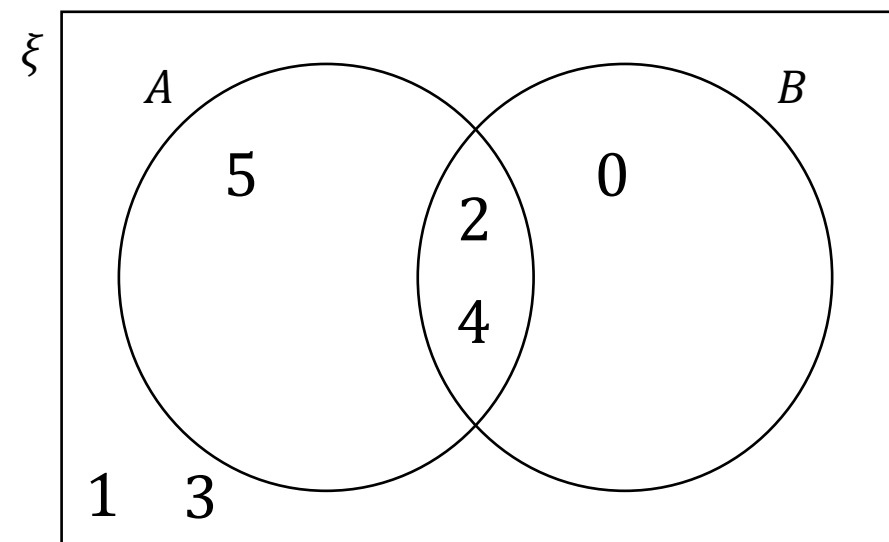
$$\xi =$$

$$A =$$

$$B =$$

$$A' =$$

$$B' =$$



Your turn

From the Venn diagram below,
write in roster notation:

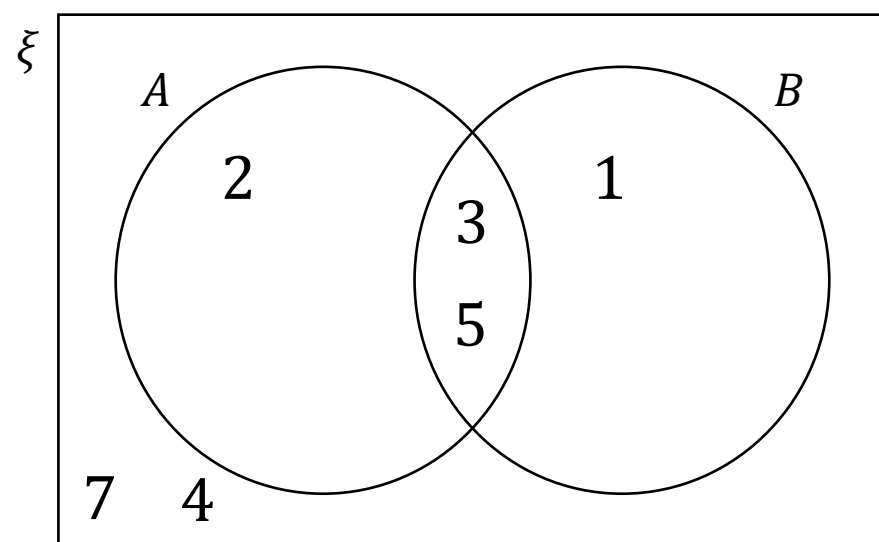
$$\xi = \{1, 2, 3, 5, 4, 7\}$$

$$A = \{2, 3, 5\}$$

$$B = \{1, 3, 5\}$$

$$A' = \{1, 4, 7\}$$

$$B' = \{2, 4, 7\}$$



Worked example

From the Venn diagram below, write in roster notation:

$$\xi =$$

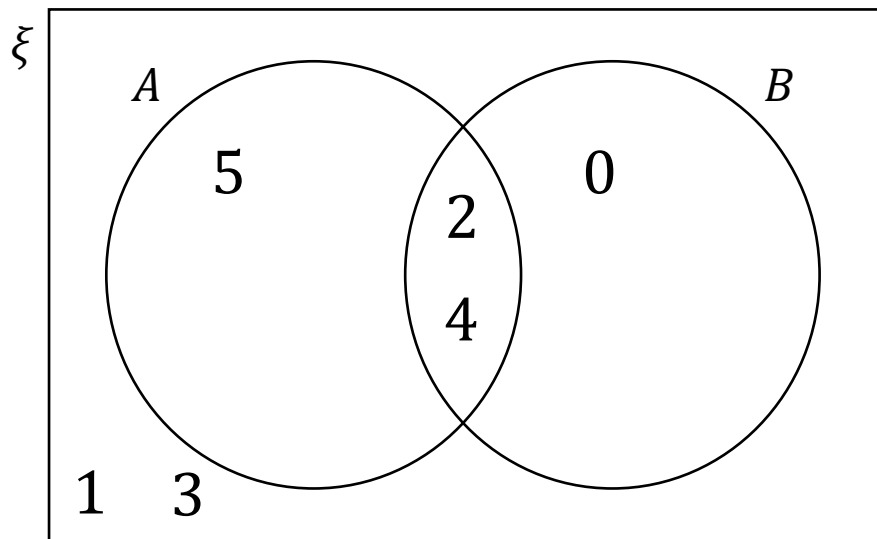
$$A \cap B =$$

$$A \cup B =$$

$$A \cap B' =$$

$$A \cup B' =$$

$$A \cap A' =$$



Your turn

From the Venn diagram below, write in roster notation:

$$\xi = \{1, 2, 3, 4, 5, 7\}$$

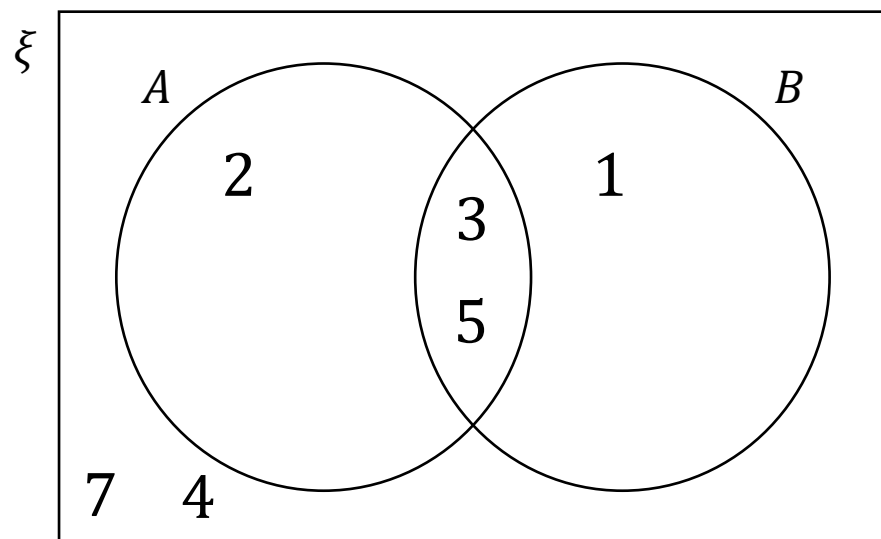
$$A \cap B = \{3, 5\}$$

$$A \cup B = \{1, 2, 3, 5\}$$

$$A \cap B' = \{2\}$$

$$A \cup B' = \{2, 3, 4, 5, 7\}$$

$$B \cap B' = \emptyset$$



Worked example

True or false?

$5 \in A$

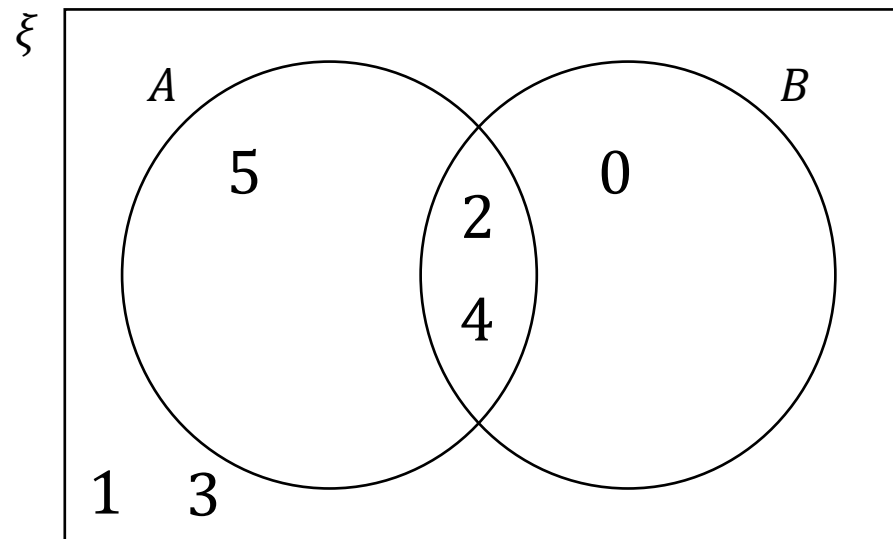
$0 \in B$

$4 \in A$

$3 \in B$

$1 \notin A$

$2 \notin B$



Your turn

True or false?

$1 \in B$ True

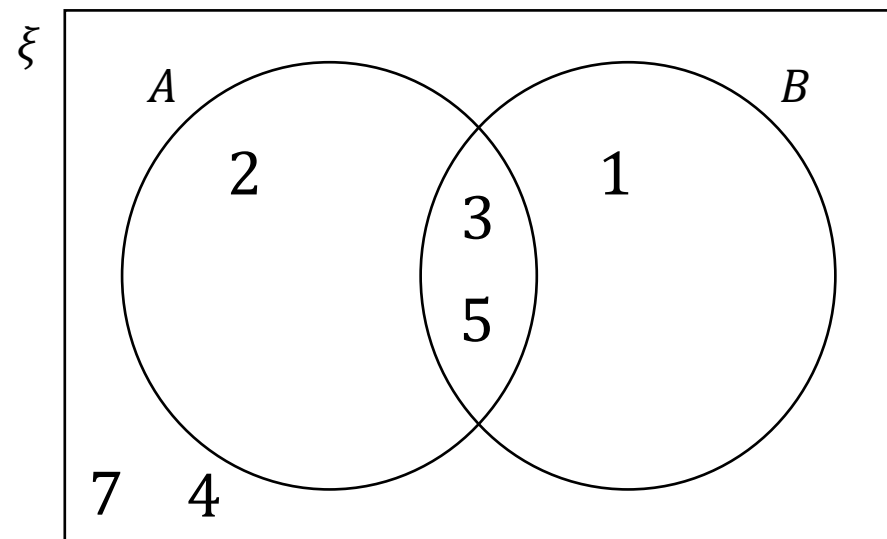
$2 \in A$ True

$3 \in B$ True

$4 \in A$ False

$5 \notin B$ False

$7 \notin A$ True



Worked example

From the Venn diagram below,
write in roster notation:

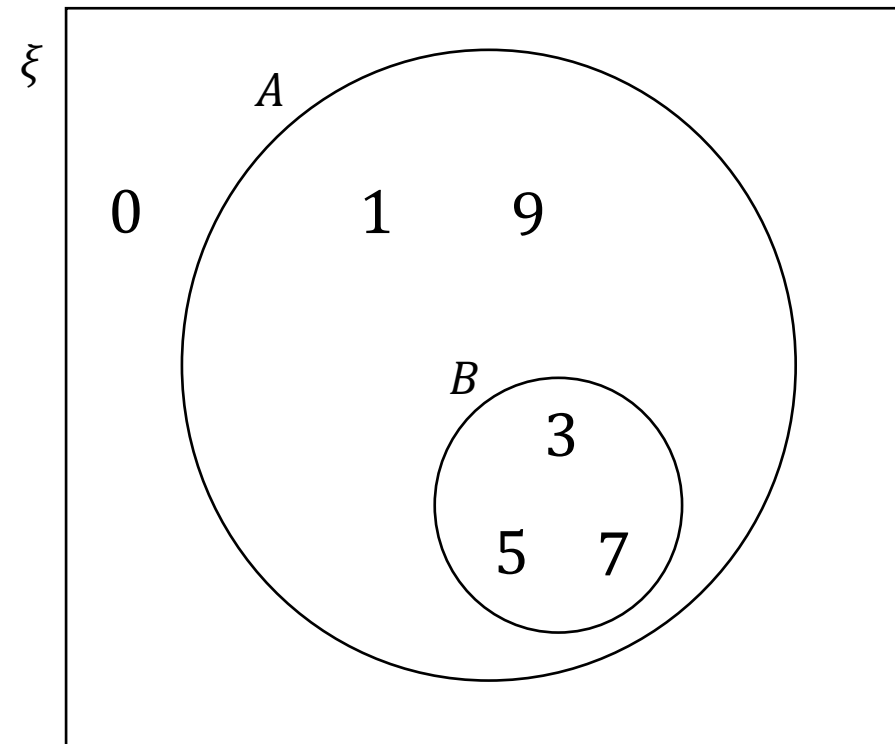
$$\xi =$$

$$A =$$

$$B =$$

$$A' =$$

$$B' =$$



Your turn

From the Venn diagram below,
write in roster notation:

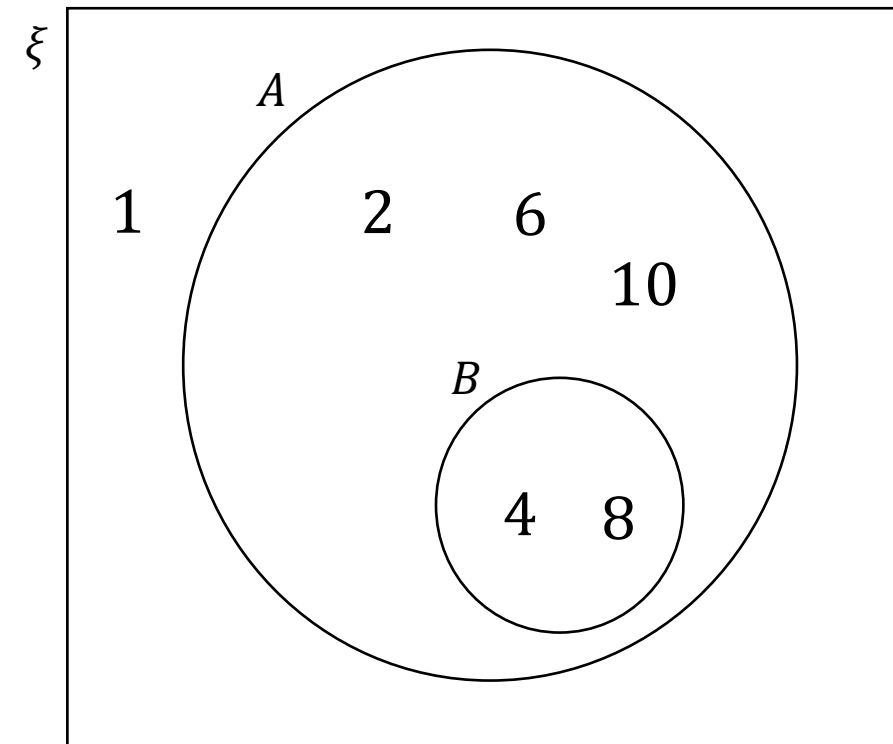
$$\xi = \{1, 2, 4, 6, 8, 10\}$$

$$A = \{2, 4, 6, 8, 10\}$$

$$B = \{4, 8\}$$

$$A' = \{1\}$$

$$B' = \{1, 2, 6, 10\}$$



Worked example

From the Venn diagram below,
write in roster notation:

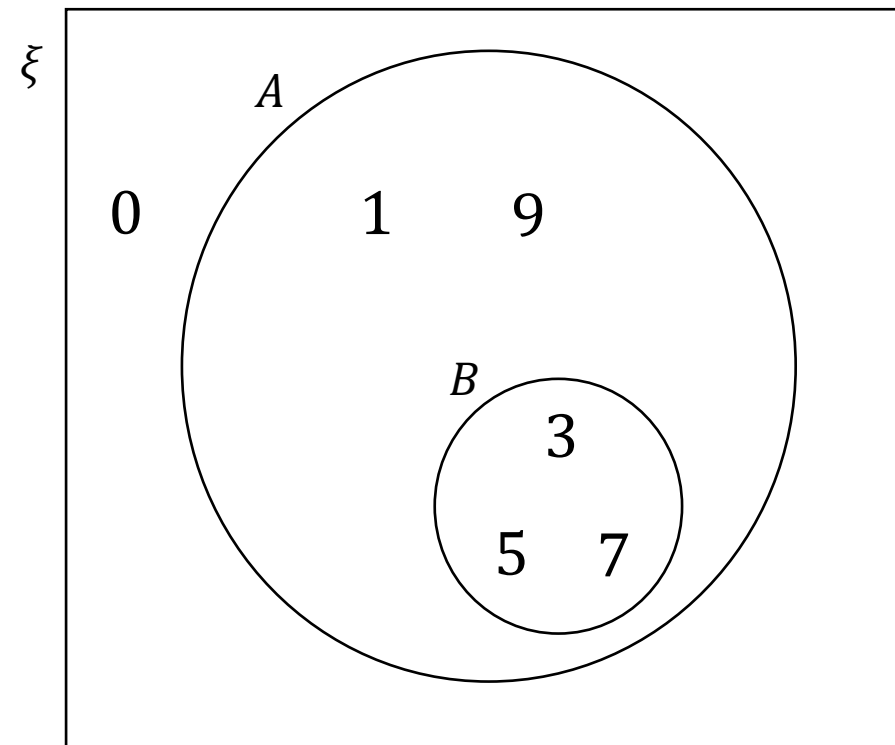
$$\xi =$$

$$A \cap B =$$

$$A \cup B =$$

$$A \cap B' =$$

$$A \cup B' =$$



Your turn

From the Venn diagram below,
write in roster notation:

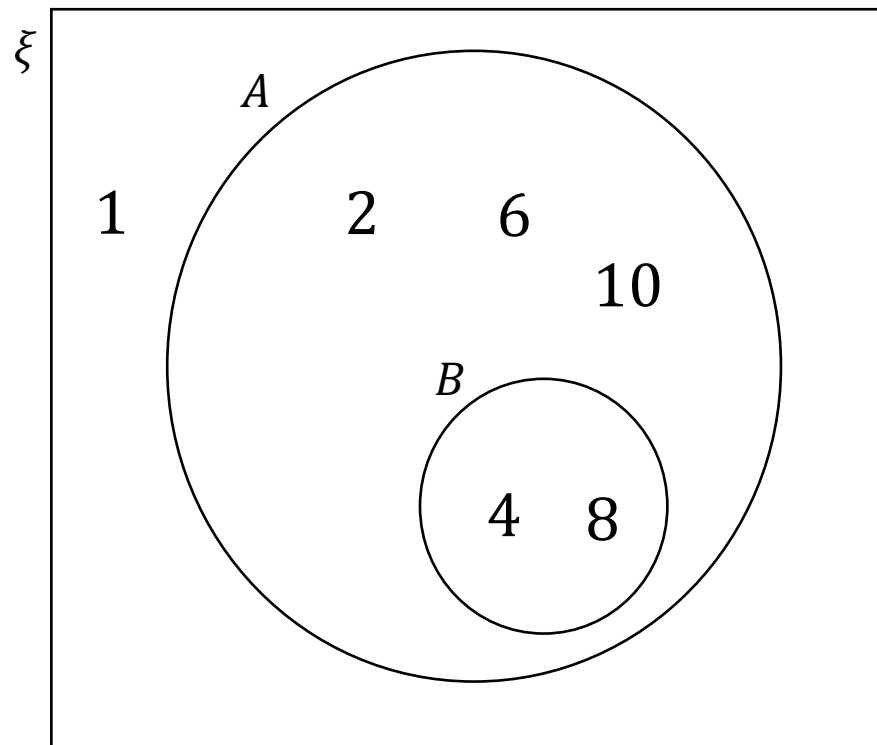
$$\xi = \{1, 2, 4, 6, 8, 10\}$$

$$A \cap B = \{4, 8\}$$

$$A \cup B = \{2, 4, 6, 8, 10\}$$

$$A \cap B' = \{2, 6, 10\}$$

$$A \cup B' = \{1, 2, 4, 6, 8, 10\}$$



Worked example

True or false?

$1 \in A$

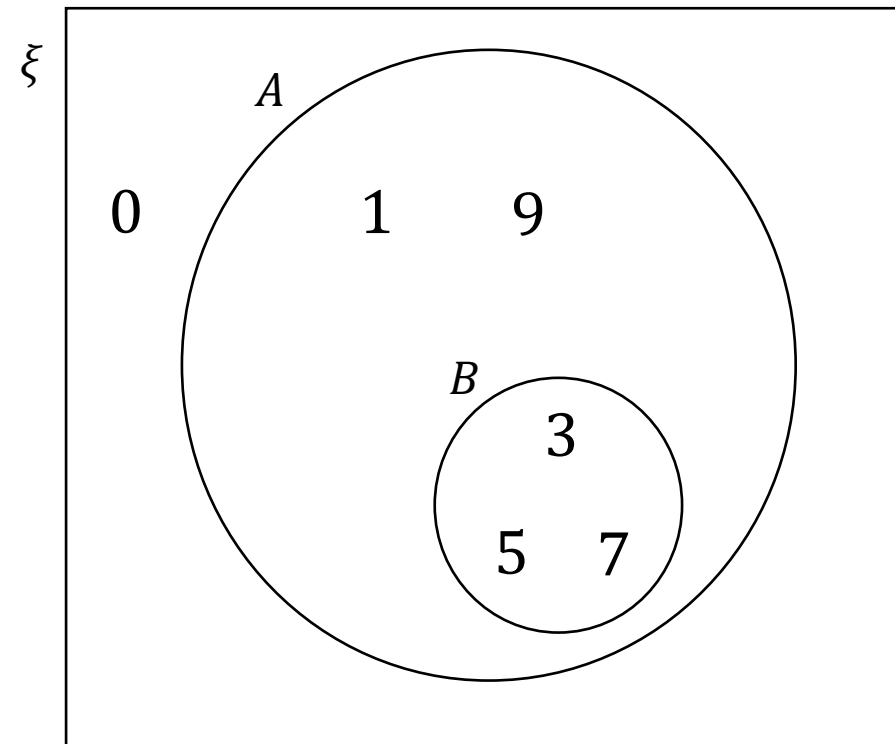
$3 \in A$

$5 \in B$

$9 \in B$

$7 \notin A$

$0 \notin B$



Your turn

True or false?

$1 \in A$ False

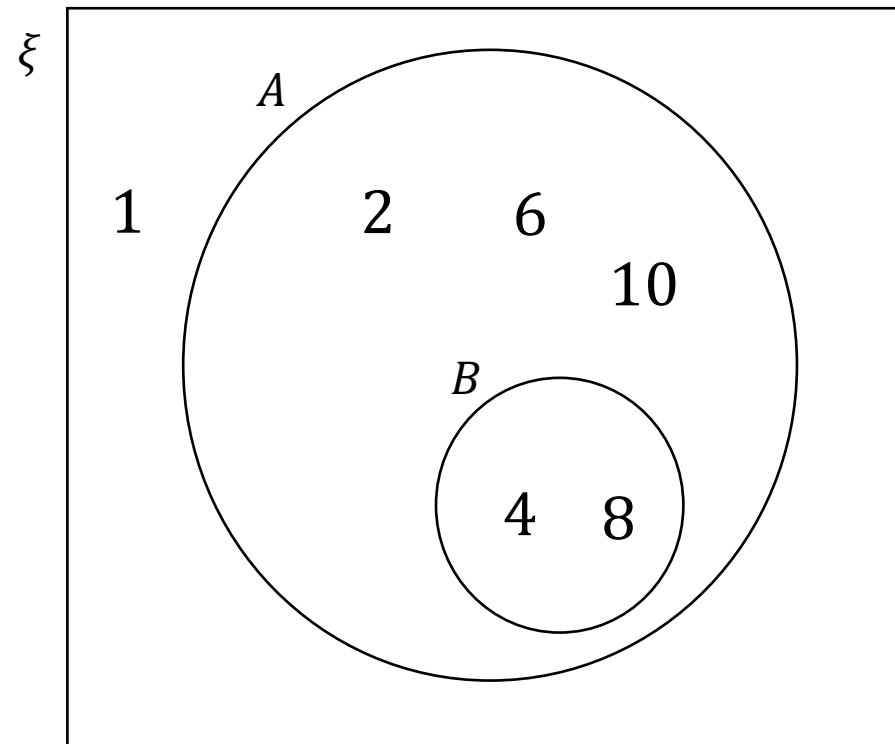
$2 \in A$ True

$4 \in B$ True

$6 \in B$ False

$8 \notin A$ False

$10 \notin B$ True



Worked example

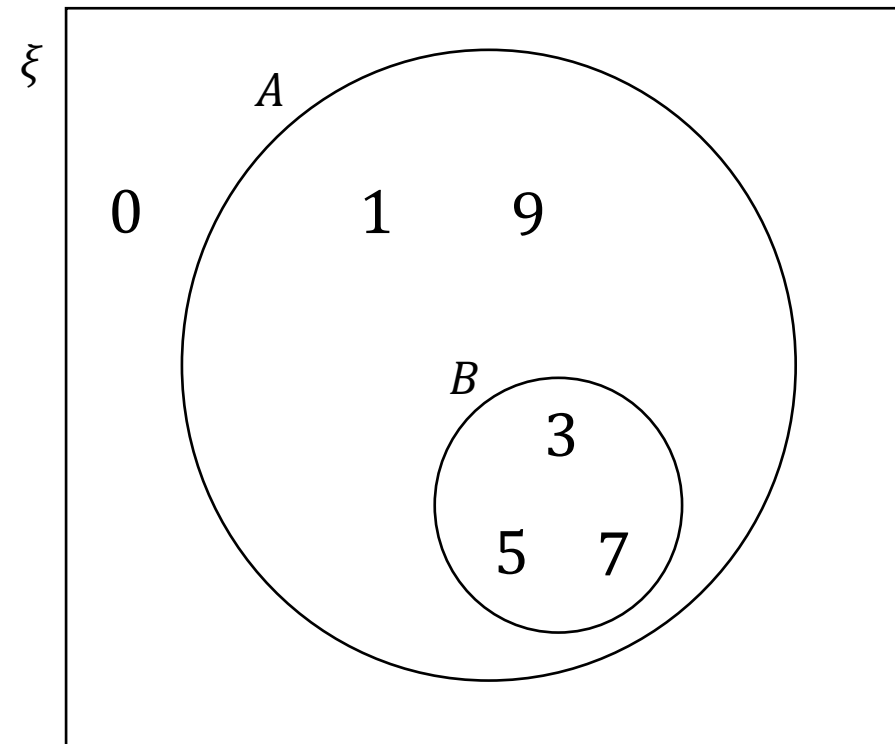
True or false?

$$A \subset B$$

$$A \not\subset B$$

$$B \subset A$$

$$B \not\subset A$$



Your turn

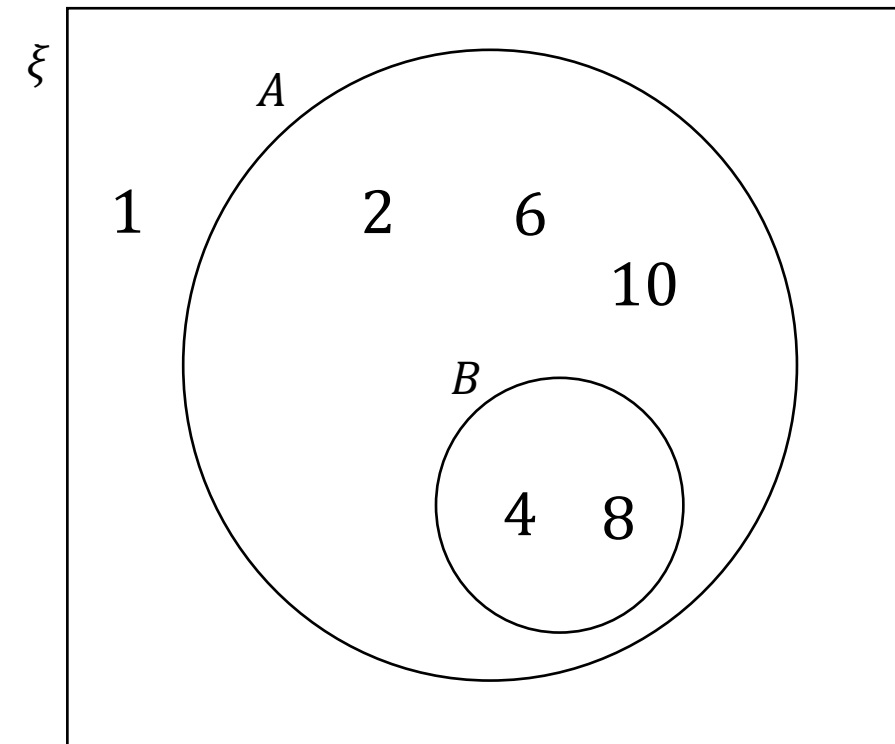
True or false?

$$A \subset B \text{ False}$$

$$A \not\subset B \text{ True}$$

$$B \subset A \text{ True}$$

$$B \not\subset A \text{ False}$$



Worked example

From the Venn diagram below,
write in roster notation:

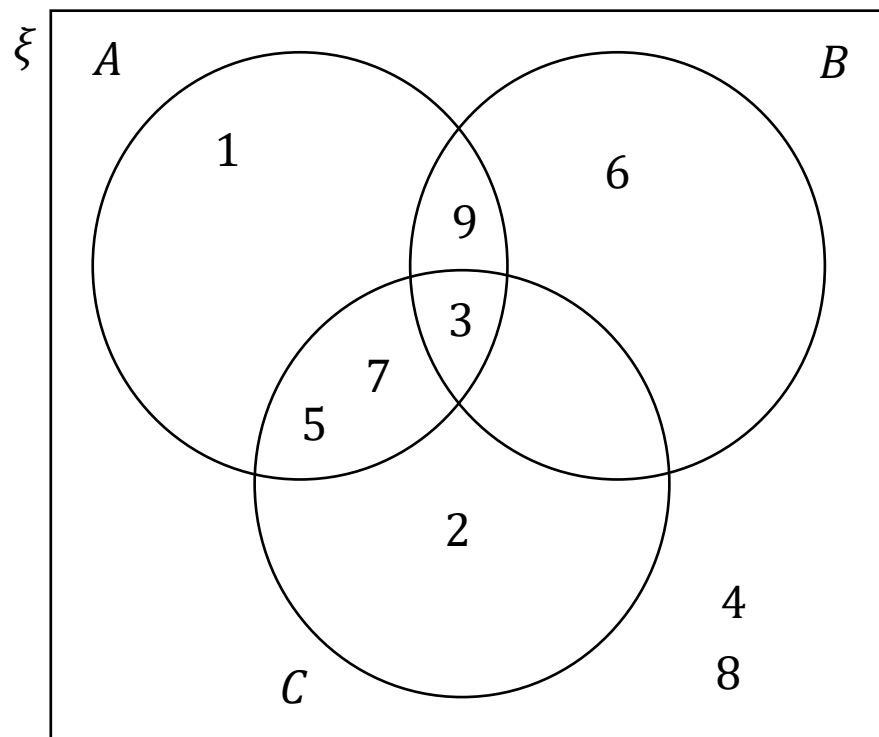
$$\xi =$$

$$A =$$

$$B =$$

$$A' =$$

$$B' =$$



Your turn

From the Venn diagram below,
write in roster notation:

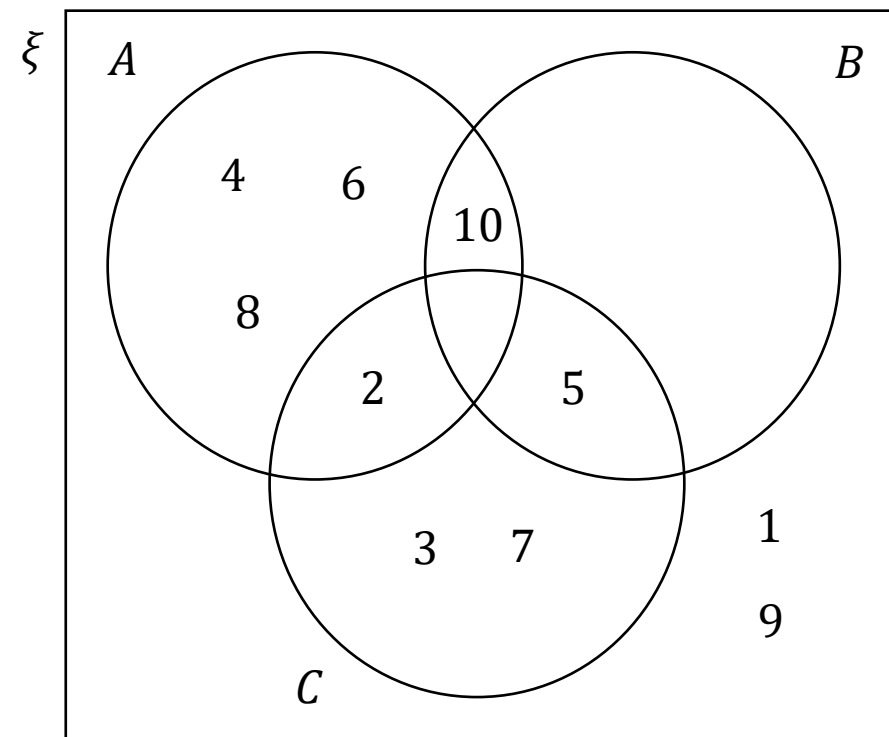
$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$B = \{5, 10\}$$

$$C = \{2, 3, 5, 7\}$$

$$B' = \{1, 2, 3, 4, 6, 7, 8, 9\}$$

$$C' = \{1, 4, 6, 8, 9, 10\}$$



Worked example

From the Venn diagram below,
write in roster notation:

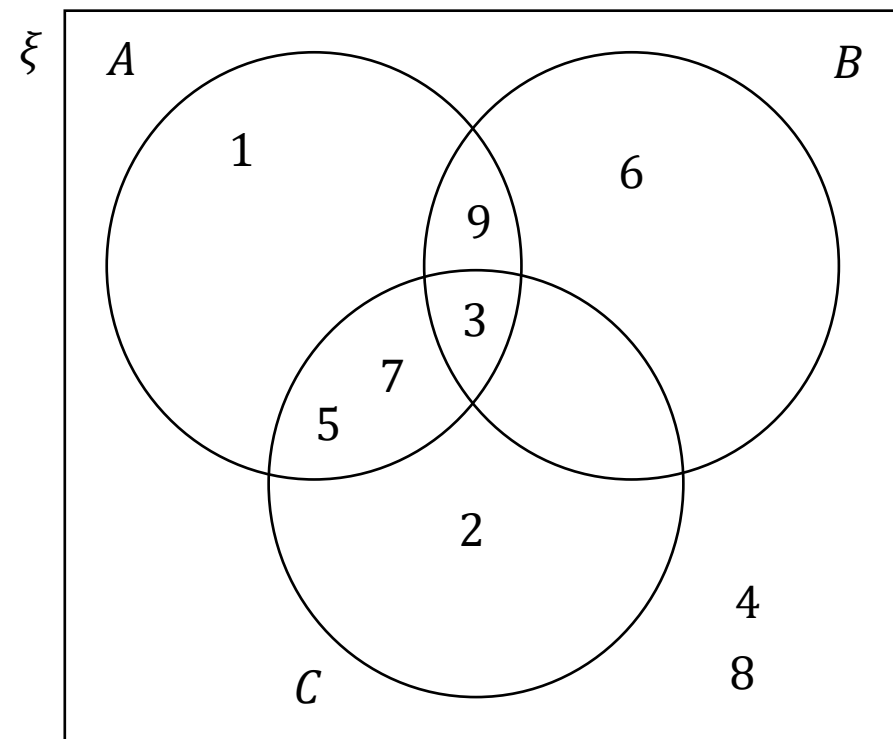
$$\xi =$$

$$A \cap B =$$

$$A \cup B =$$

$$A \cap B' =$$

$$A \cup B' =$$



Your turn

From the Venn diagram below,
write in roster notation:

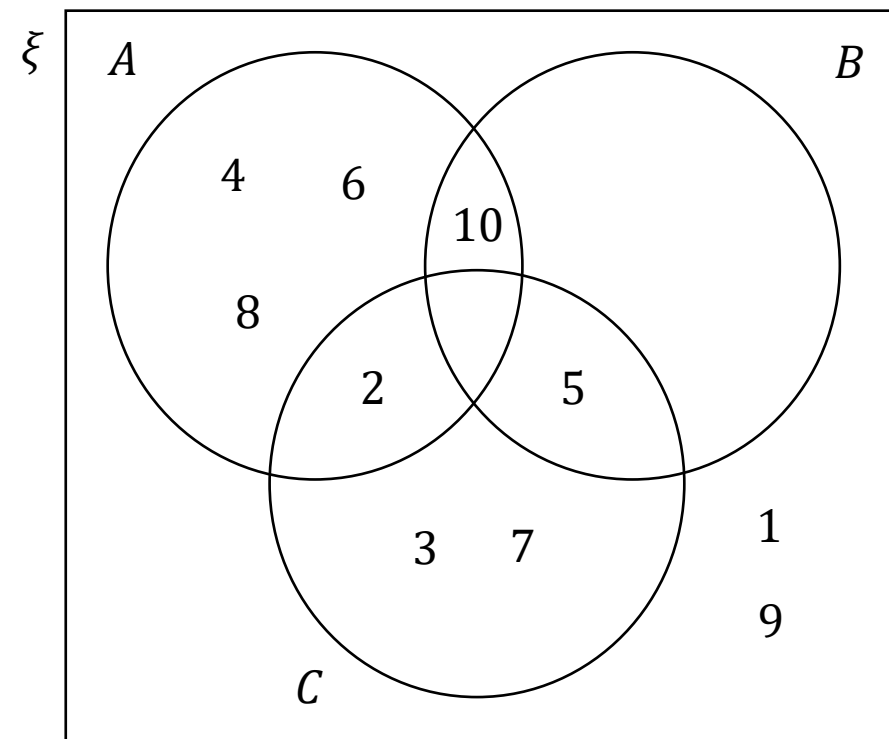
$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$B \cap C = \{5\}$$

$$B \cup C = \{2, 3, 5, 7, 10\}$$

$$A \cap C' = \{4, 6, 8, 10\}$$

$$A \cup C' = \{1, 2, 4, 6, 8, 9, 10\}$$



Worked example

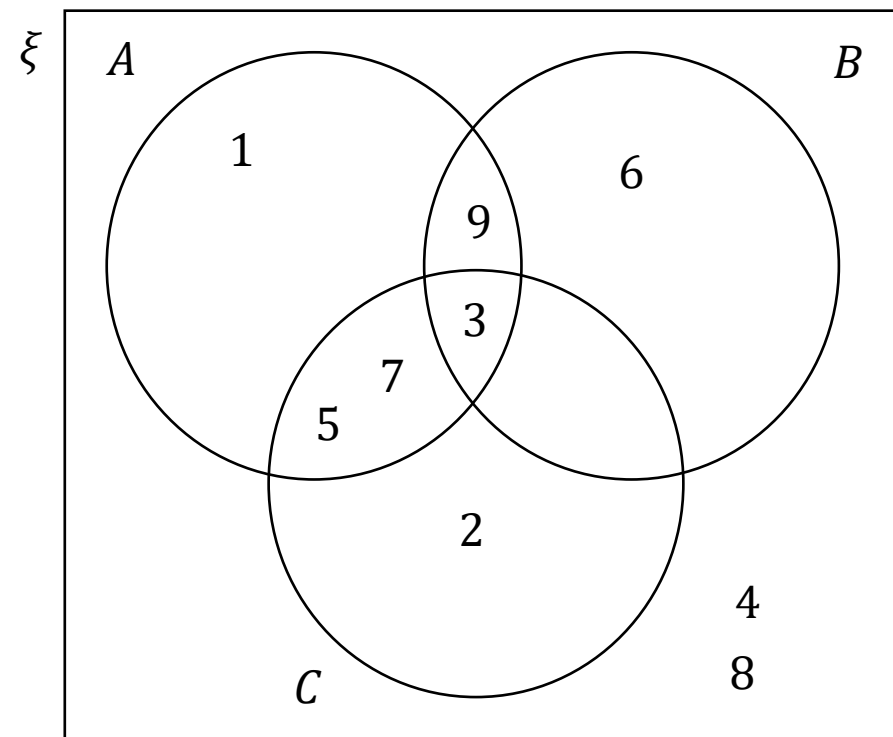
From the Venn diagram below, describe the sets:

$\xi =$

$A =$

$B =$

$C =$



Your turn

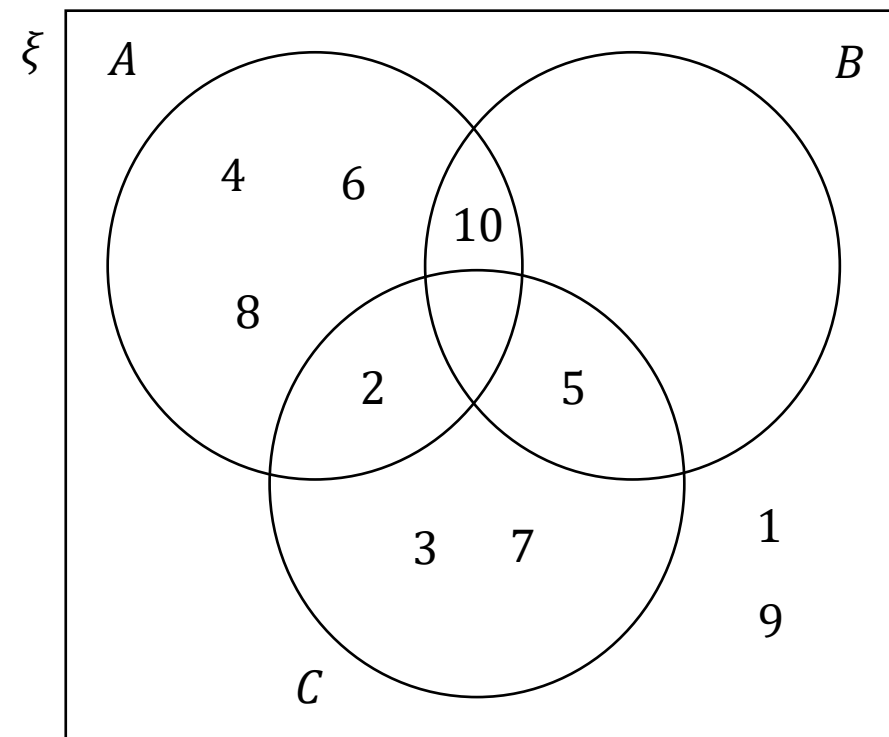
From the Venn diagram below, describe the sets:

$\xi = \{\text{Integers from 1 to 10 inclusive}\}$

$A = \{\text{Even numbers}\}$

$B = \{\text{Multiples of 5}\}$

$C = \{\text{Prime numbers}\}$



Worked example

$$A = \{1, 3, 5, 7, 9, 11\}$$

$$B = \{3, 5, 7, 11\}$$

True or false?

$$A \subset B$$

$$A \not\subset B$$

$$B \subset A$$

$$B \not\subset A$$

Your turn

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

$$B = \{4, 8, 12\}$$

True or false?

$$A \subset B \quad \text{False}$$

$$A \not\subset B \quad \text{True}$$

$$B \subset A \quad \text{True}$$

$$B \not\subset A \quad \text{False}$$

Worked example

$$A = \{1, 3, 5, 7\}$$

$$B = \{2, 4, 5, 7\}$$

$$A \cap B =$$

$$A = \{1, 3, 5, 7\}$$

$$C = \{2, 4, 6, 8\}$$

$$A \cap B =$$

$$X = \{cat, dog, bat, fox\}$$

$$Y = \{cats, dogs, bats, foxes\}$$

$$X \cap Y =$$

Your turn

$$R = \{2, 3, 5, 7, 11, 13\}$$

$$S = \{1, 4, 9, 16, 25, 36\}$$

$$R \cap S = \emptyset$$

Worked example

$A = \{\text{Letters in the English alphabet}\}$

$B = \{\text{vowels in the English alphabet}\}$

$C = \{a, e, i, o, u\}$

$D = \{a, b, c, \alpha, \beta, \gamma, \delta, \tau, \theta\}$

True or false?

$B \subset A$

$B \subseteq C$

$C \subseteq A$

$D \subset A$

Your turn

$A = \{\text{Letters in the English alphabet}\}$

$B = \{\text{consonants in the English alphabet}\}$

$C = \{b, c, d, f, g, h, i, j, k, l, m, n, p, q, r, s, t, v, w, x, y, z\}$

$D = \{b, c, d, f, \mu, \pi, \rho, \sigma\}$

True or false?

$B \subset A$ **True**

$B \subseteq A$ **False**

$A \subseteq D$ **False**

$D \subset C$ **False**

Worked example

$$A = \{a, b, c\}$$

How many subsets does the set have?

Your turn

$$A = \{a, b, c, d\}$$

How many subsets does the set have?

16:

$\emptyset$

$\{a\}, \{b\}, \{c\}, \{d\}$

$\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}$ and $\{c, d\}$

$\{a, b, c\}, \{a, b, d\}, \{a, c, d\}$, and $\{b, c, d\}$

$\{a, b, c, d\}$

Worked example

What is the rule for this set?

$\{1, 4, 9, 16, \dots\}$

Is it finite or infinite?

What is the rule for this set?

$\{2, 4, 8, 16\}$

Is it finite or infinite?

What is the order?

Your turn

What is the rule for this set?

$\{3, 9, 27, 81, 243\}$

Is it finite or infinite?

What is the order?

Positive integer powers of 3
between 1 and 3 inclusive
 3^n where $n = 1, 2, 3$ only
Finite, order 5

What is the rule for this set?

$\{1, 8, 27, 64, \dots\}$

Is it finite or infinite?

Cube numbers.
 n^3 where $n \in \mathbb{N}$
Infinite

Worked example

$$\xi = \{x: x \text{ is an integer}\}$$

$$A = \{x: x \text{ is prime}\}$$

$$B = \{x: x \text{ is even}\}$$

Write in roster notation the following sets:

$$A \cap B =$$

$$A \cup B =$$

$$B' =$$

Your turn

$$\xi = \{x: x \text{ is a positive even number}\}$$

$$A = \{2, 4, 6\}$$

$$B = \{x: x \text{ is a multiple of 4}\}$$

Write in roster notation the following sets:

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

$$A \cup B = \{2, 4, 6, 8, 12, 16, \dots\}$$

$$A' = \{8, 10, 12, 14, 16, \dots\}$$

Worked example

Represent in a Venn diagram:

$\xi = \{x: x \text{ is an integer between 1 and 10 inclusive}\}$

$A = \{x: x \text{ is odd}\}$

$B = \{x: x \text{ is greater than 4}\}$

$C = \{x: x \text{ is less than 3}\}$

Your turn

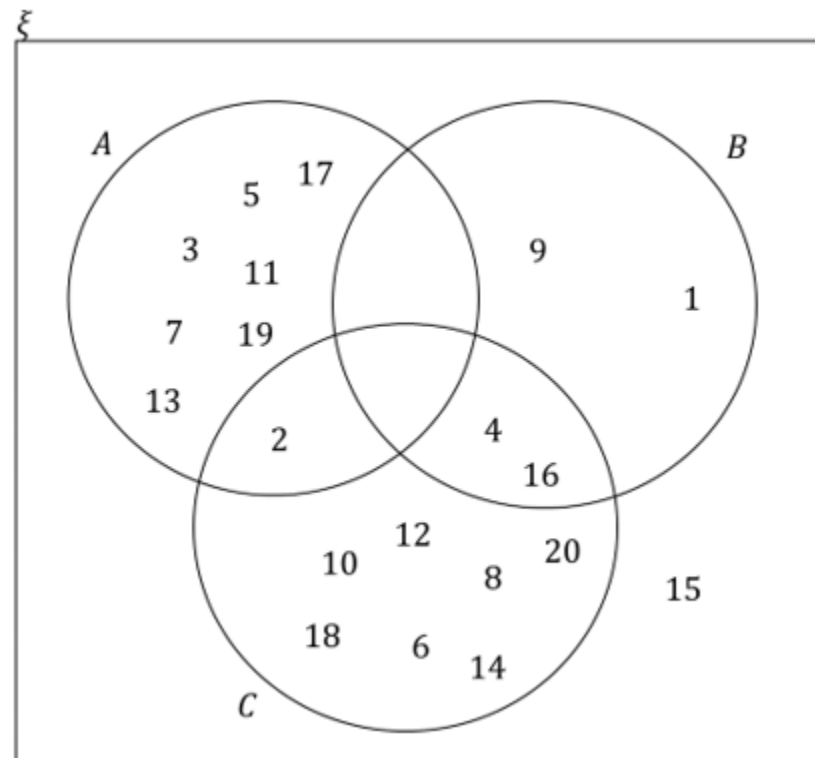
Represent in a Venn diagram:

$\xi = \{x: x \text{ is an integer between 1 and 20 inclusive}\}$

$A = \{x: x \text{ is prime}\}$

$B = \{x: x \text{ is a square number}\}$

$C = \{x: x \text{ is even}\}$



Worked example

Describe the following set in words:

$$A \cap B'$$

Write the following set in set notation:

All elements that are either not in A, or are in B.

Your turn

Describe the following set in words:

$$A' \cup B'$$

Not in A or Not in B

Write the following in set notation:

All elements that are not in A, and are in B.

$$A' \cap B$$

Worked example

Represent as a Venn diagram:

$$\xi = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

$$A = \{0, 1, 3, 5, 8\}$$

$$B = \{2, 5, 8, 9\}$$

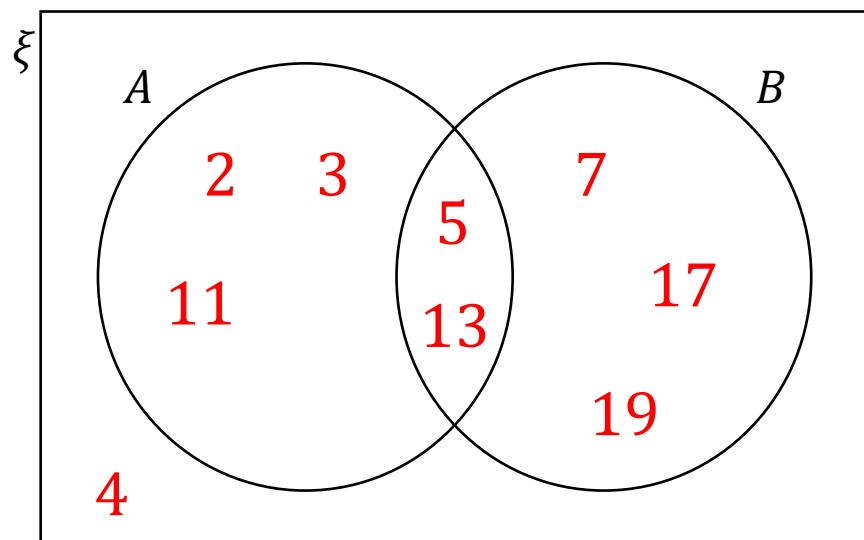
Your turn

Represent as a Venn diagram:

$$\xi = \{2, 3, 4, 5, 7, 11, 13, 17, 19\}$$

$$A = \{2, 3, 5, 11, 13\}$$

$$B = \{5, 7, 13, 17, 19\}$$



Worked example

Represent as a Venn diagram:
 ξ = Positive integers between 1 and 10 inclusive

$A = \{\text{Prime numbers}\}$

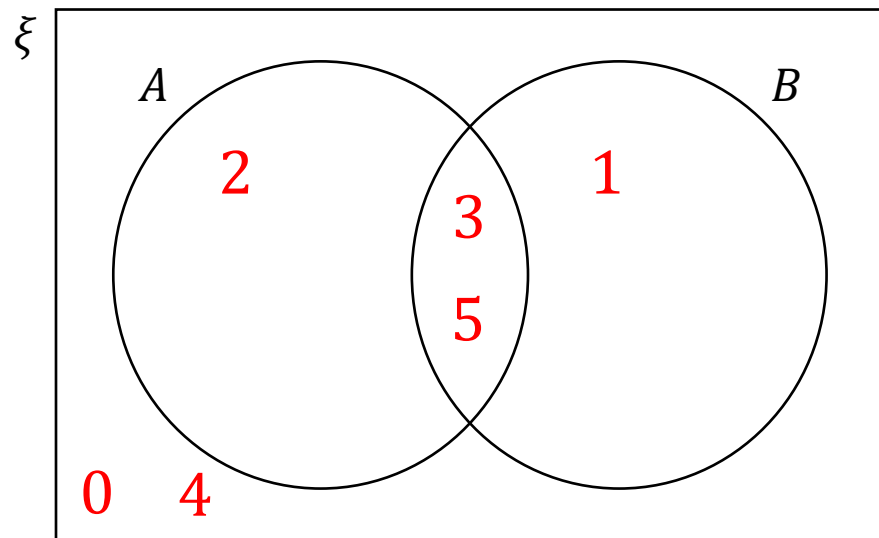
$B = \{\text{Even numbers}\}$

Your turn

Represent as a Venn diagram:
 ξ = Integers between 0 and 5 inclusive

$A = \{\text{Prime numbers}\}$

$B = \{\text{Odd numbers}\}$



Worked example

Represent as a Venn diagram:
 ξ = Positive integers between 1 and 10 inclusive

A = {Multiples of 2}

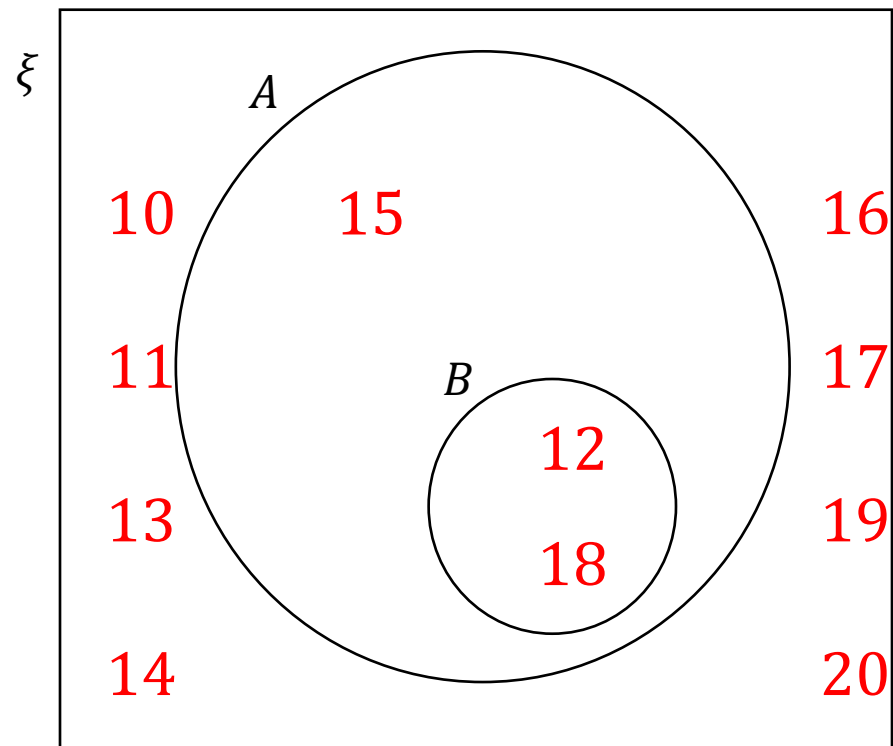
B = {Multiples of 4}

Your turn

Represent as a Venn diagram:
 ξ = Positive integers between 10 and 20 inclusive

A = {Multiples of 3}

B = {Multiples of 6}



Worked example

In a group of 28 scientists:

- 20 have degrees in Physics.
- 18 have degrees in Chemistry.
- Some have degrees in both
- 4 scientists have degrees which are neither Physics nor Chemistry.

Find the number of scientists who have degrees in both Physics and Chemistry.

Your turn

In a group of 30 mathematicians:

- 15 have studied Calculus.
- 22 have studied Topology.
- Some have studied both.
- 3 mathematicians have not yet studied either Calculus or topology

Find the number of mathematicians who have studied both Calculus and Topology.

10

Worked example

There are 150 pupils. The examinations available are: English, Maths and Science.

- 15 pupils are sitting English and Maths but not science
- 20 pupils are sitting Science and Maths but not English
- 18 pupils are sitting Science and English but not Maths
- 8 pupils are sitting all three exams.
- 55 are sitting English in total
- 72 are sitting Maths in total
- 65 are sitting Science in total

How many pupils do not sit any of the examinations?

Your turn

There are 130 pupils. The examinations available are: English, Maths and Science.

- 10 pupils are sitting English and Maths but not science
- 20 pupils are sitting Science and Maths but not English
- 9 pupils are sitting Science and English but not Maths
- 13 pupils are sitting all three exams.
- 49 are sitting English in total
- 83 are sitting Maths in total
- 62 are sitting Science in total

How many pupils do not sit any of the examinations? **1**

Worked example

A = the set of days in the week that begin with the letter T:

$A =$

$n(A) =$

Tuesday $\in A$?

Friday $\in A$?

Your turn

C = the set of days in the week that students do not have school:

$C = \{Saturday, Sunday\}$

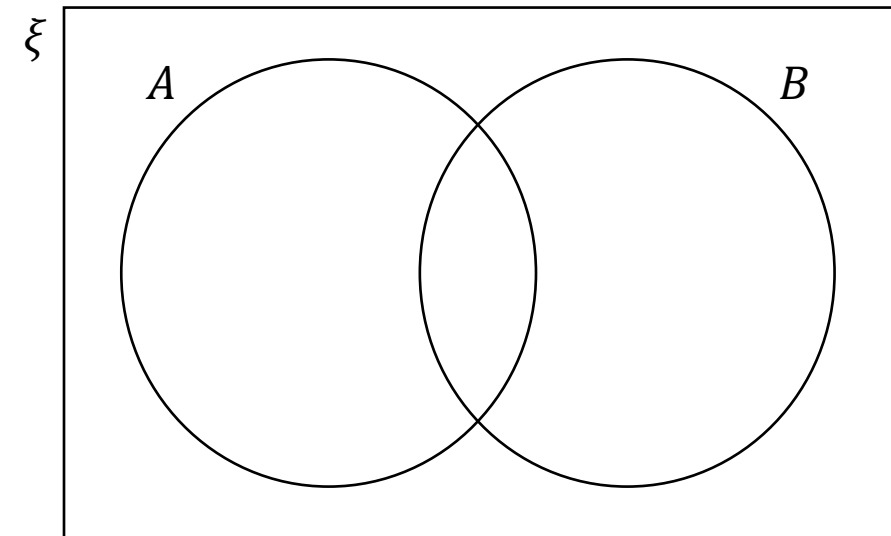
$n(C) = 2$

Tuesday $\in A$? True

Sunday $\in A$? False

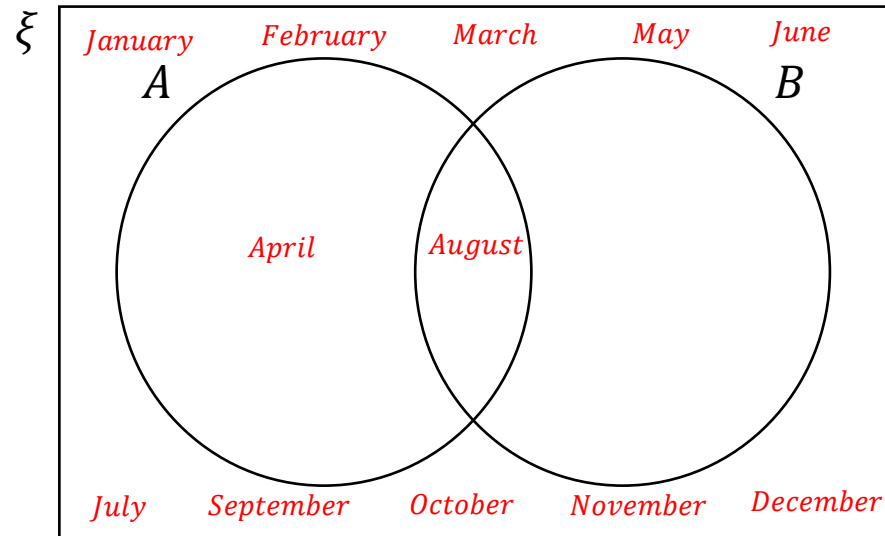
Worked example

$\xi = \{\text{Days of the week}\}$
 $A = \{\text{Tuesday, Thursday}\}$
 $B = \{\text{Days starting with S or T}\}$
Draw a Venn diagram to represent this information.



Your turn

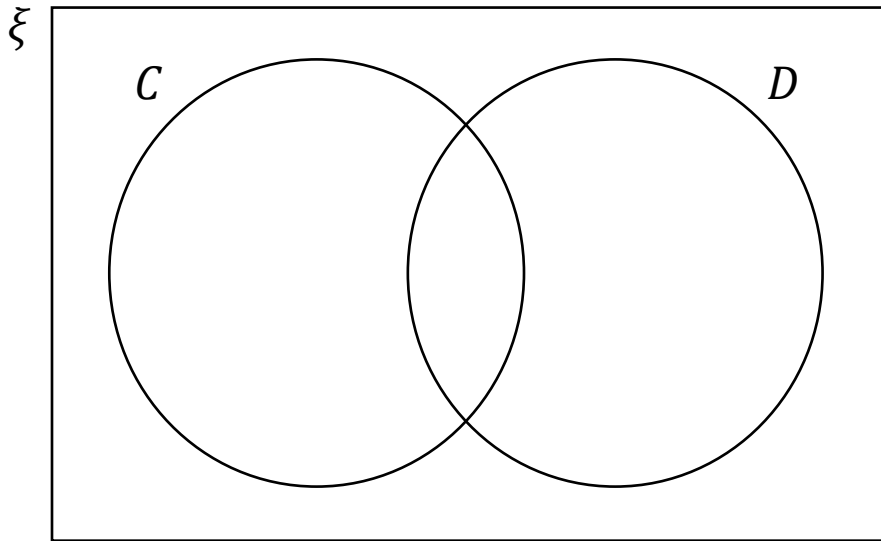
$\xi = \{\text{Months of the year}\}$
 $A = \{\text{Months starting with A}\}$
 $B = \{\text{Months with six letters}\}$
Draw a Venn diagram to represent this information.



Worked example

On the Venn diagram, shade the region representing:

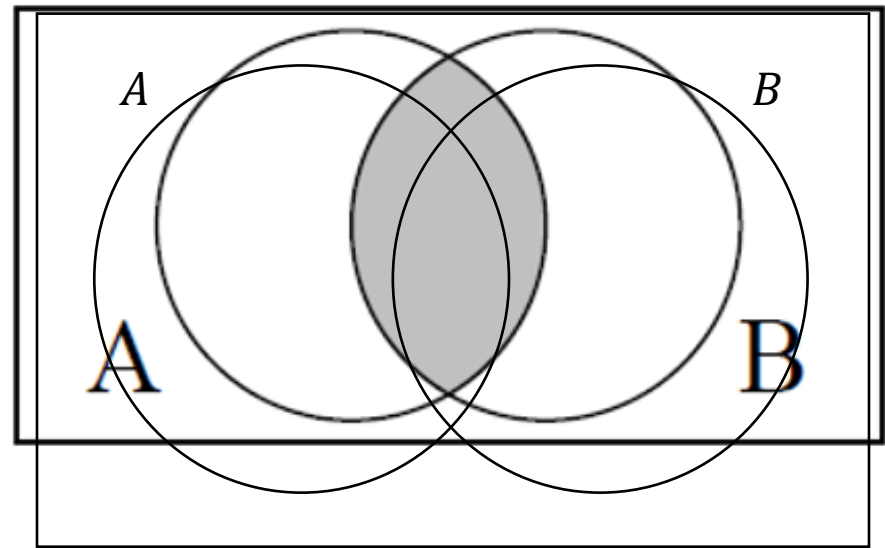
$$C \cap D$$



Your turn

On the Venn diagram, shade the region representing:

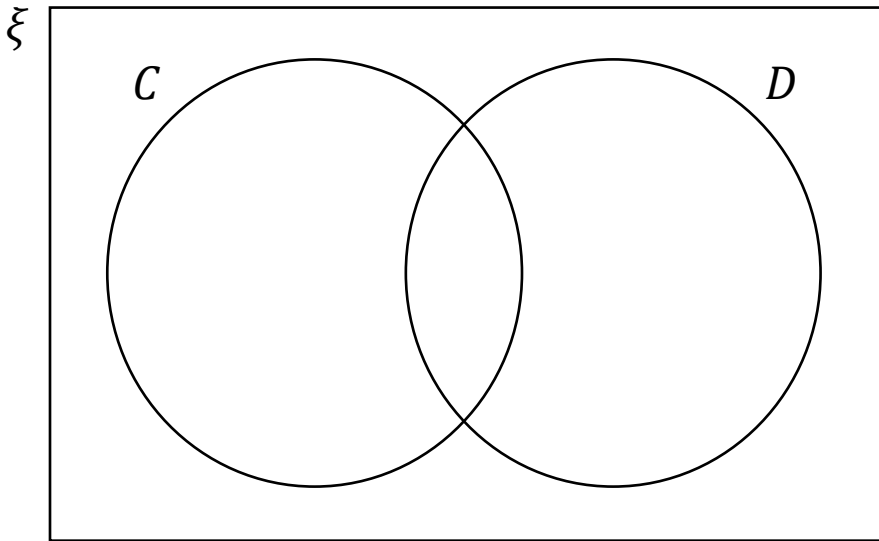
$$A \cap B$$



Worked example

On the Venn diagram, shade the region representing:

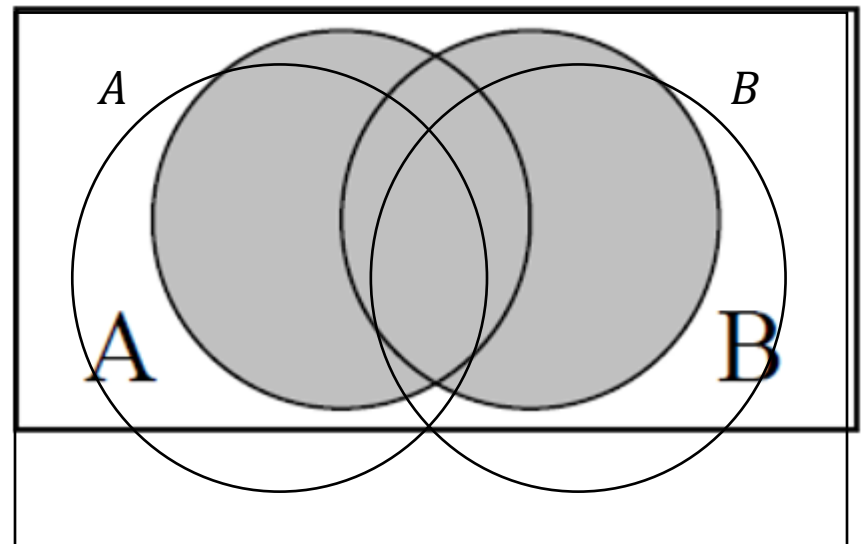
$$C \cup D$$



Your turn

On the Venn diagram, shade the region representing:

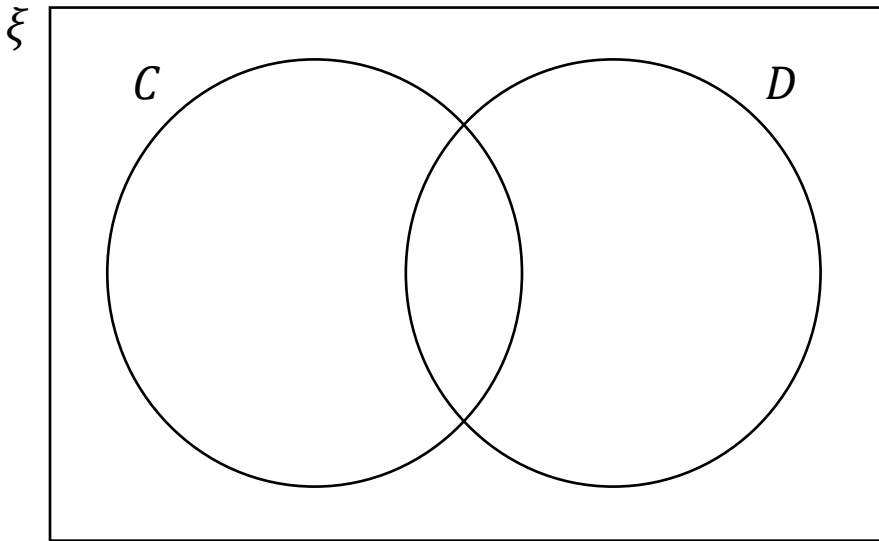
$$A \cup B$$



Worked example

On the Venn diagram, shade the region representing:

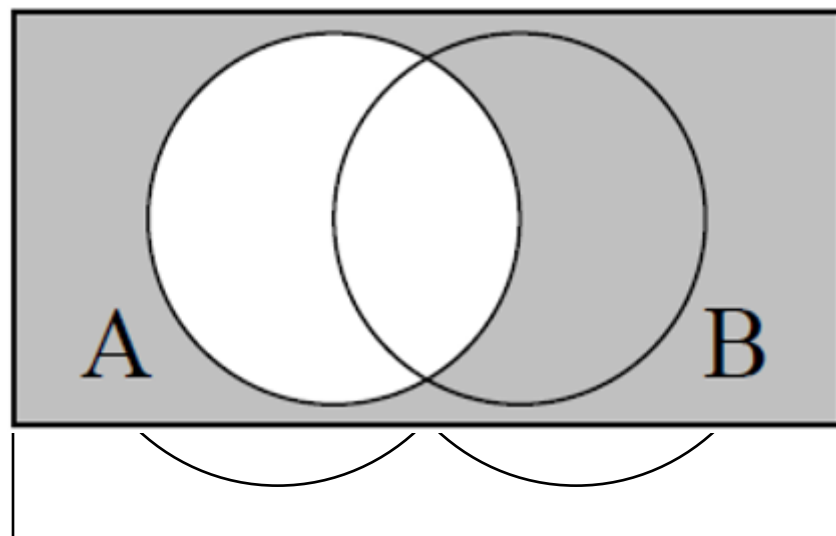
D'



Your turn

On the Venn diagram, shade the region representing:

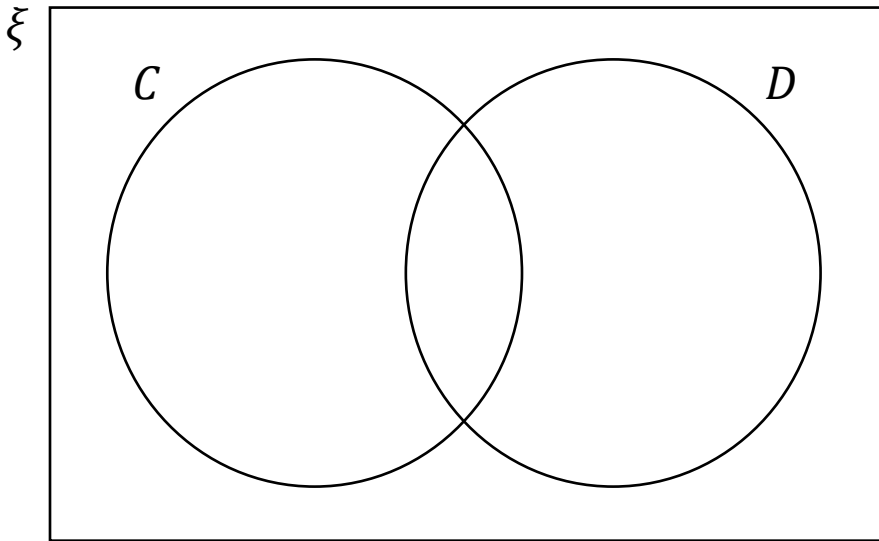
A'



Worked example

On the Venn diagram, shade the region representing:

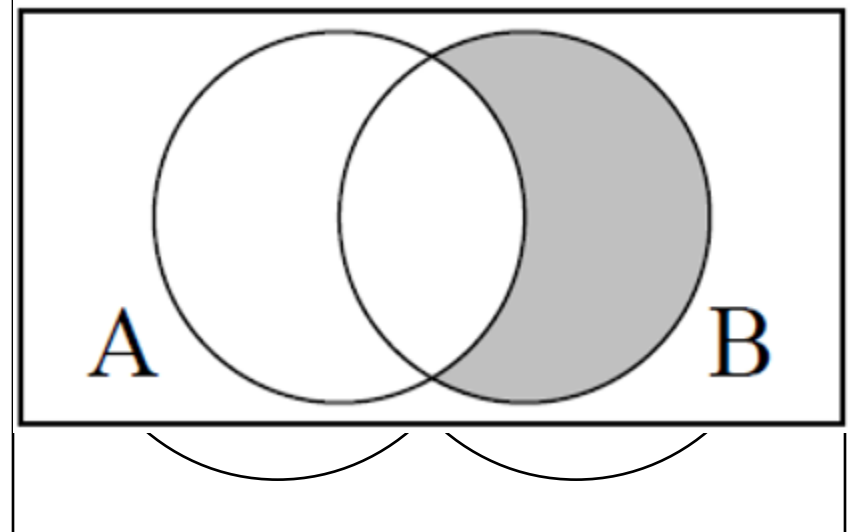
$$C \cap D'$$



Your turn

On the Venn diagram, shade the region representing:

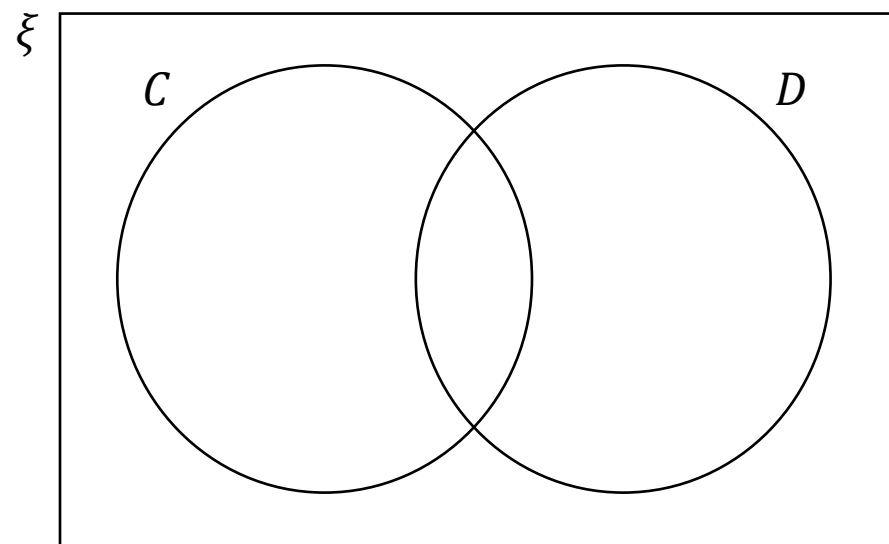
$$A' \cap B$$



Worked example

On the Venn diagram, shade the region representing:

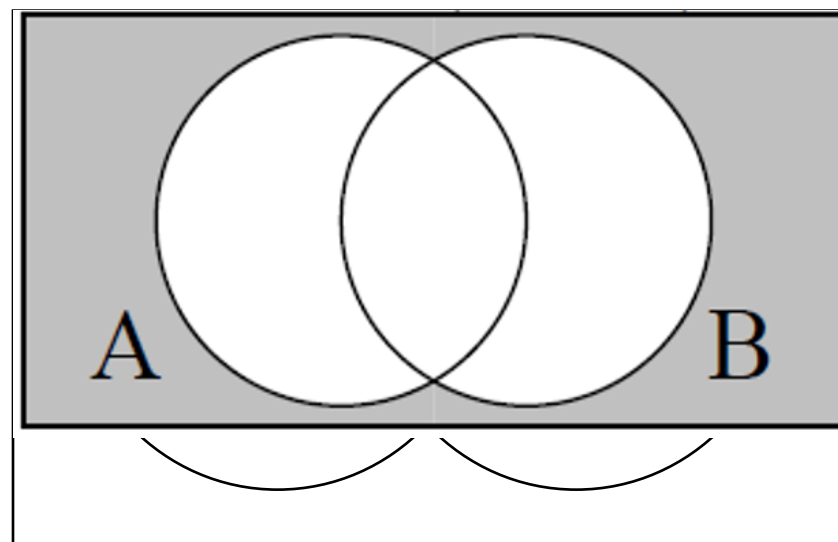
$$(C \cup D)' \text{ or } C' \cap D'$$



Your turn

On the Venn diagram, shade the region representing:

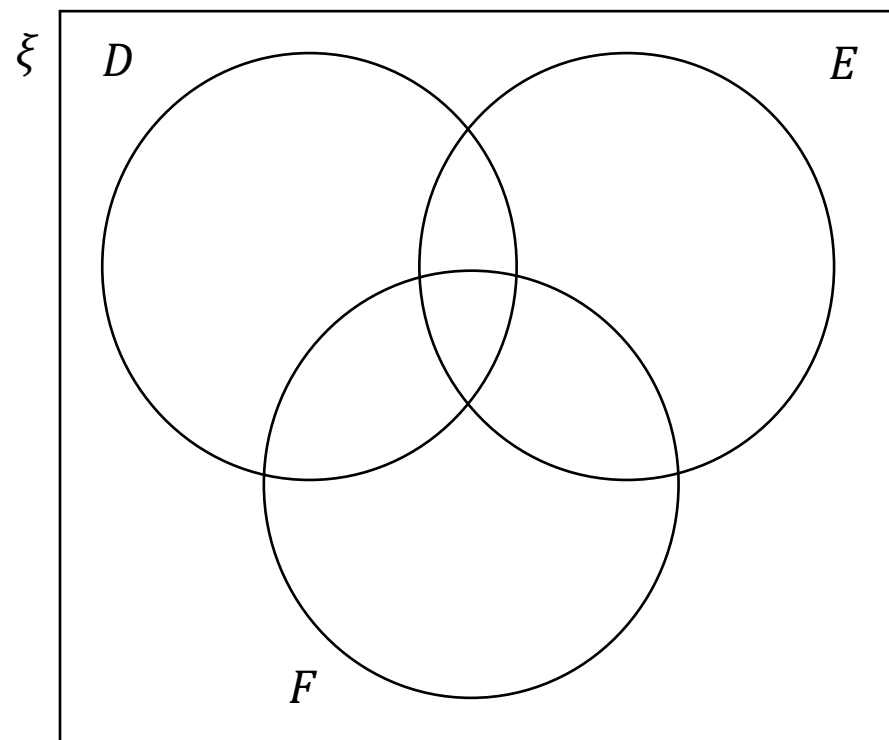
$$(A \cup B)' \text{ or } A' \cap B'$$



Worked example

On the Venn diagram, shade the region representing:

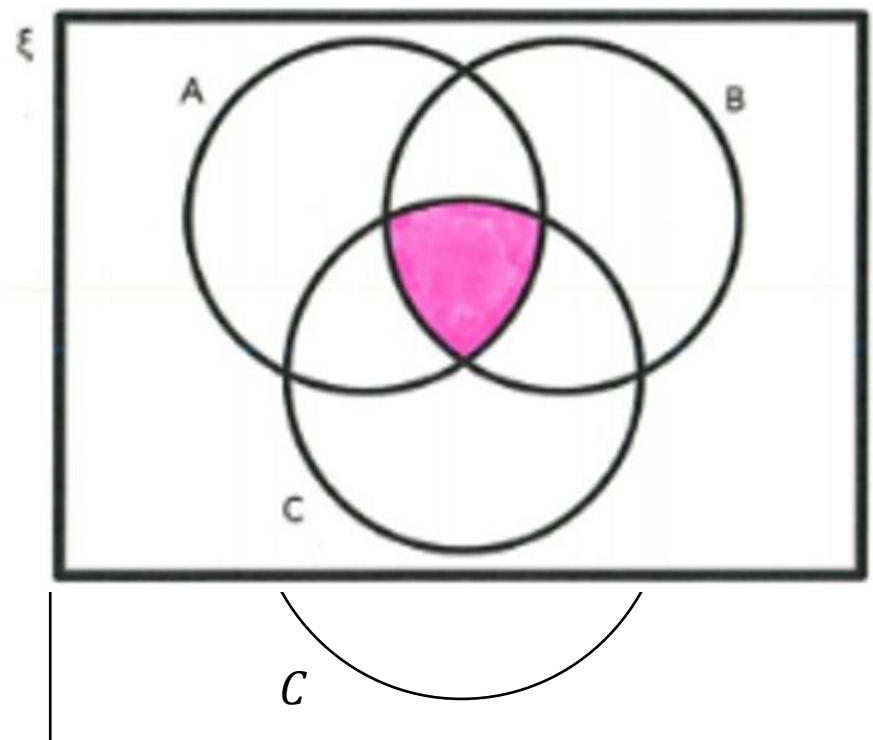
$$D \cap E \cap F$$



Your turn

On the Venn diagram, shade the region representing:

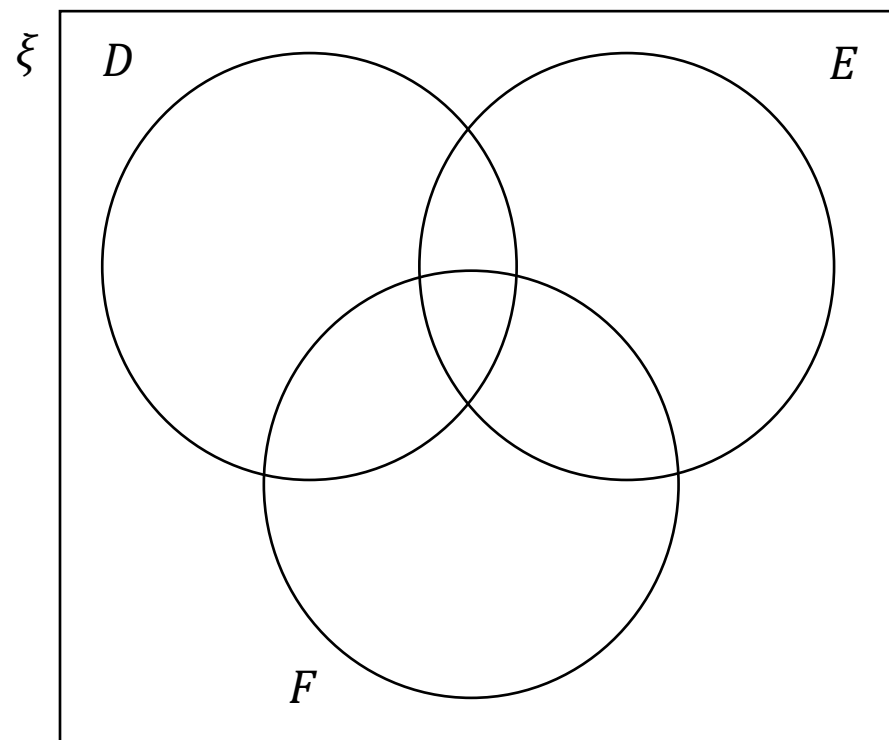
$$A \cap B \cap C$$



Worked example

On the Venn diagram, shade the region representing:

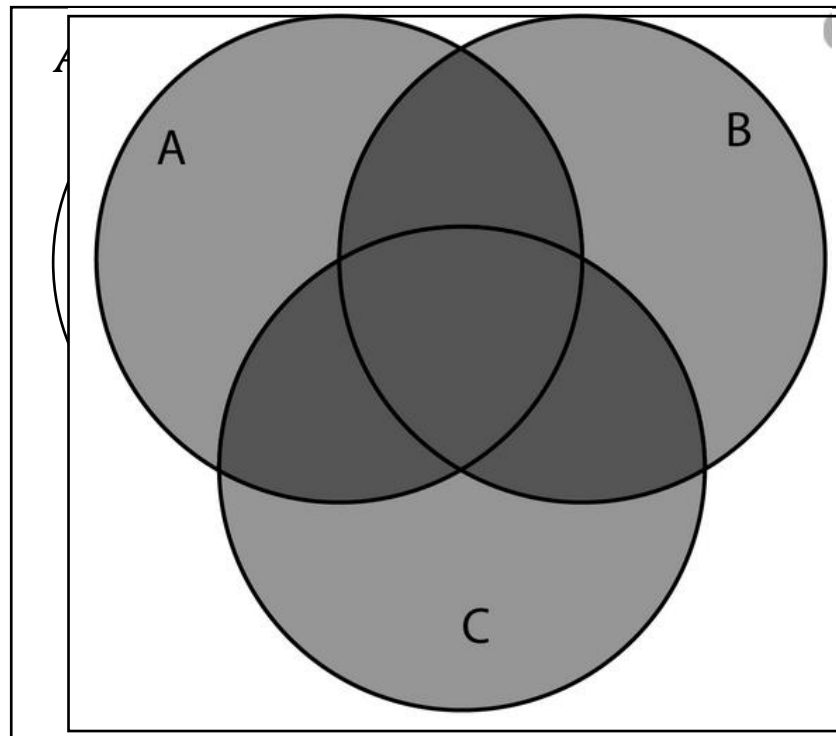
$$D \cup E \cup F$$



Your turn

On the Venn diagram, shade the region representing:

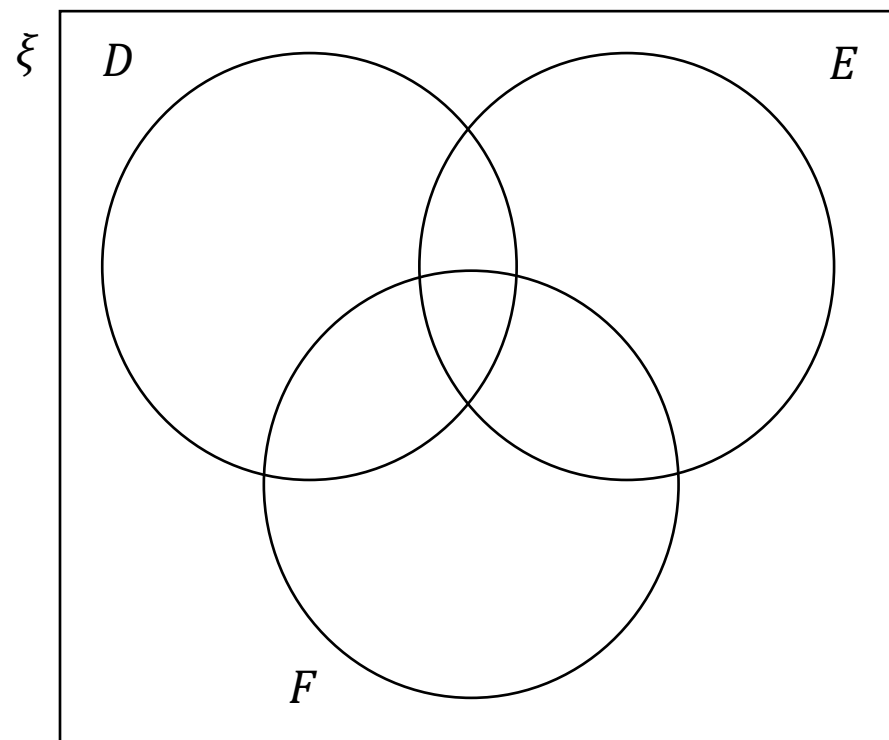
$$A \cup B \cup C$$



Worked example

On the Venn diagram, shade the region representing:

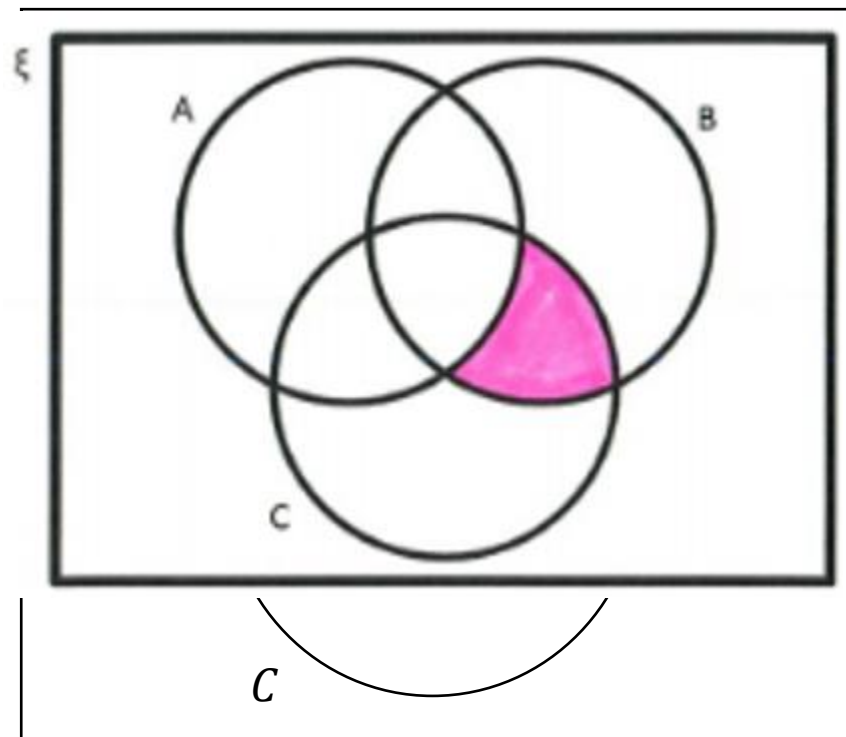
$$D \cap E' \cap F$$



Your turn

On the Venn diagram, shade the region representing:

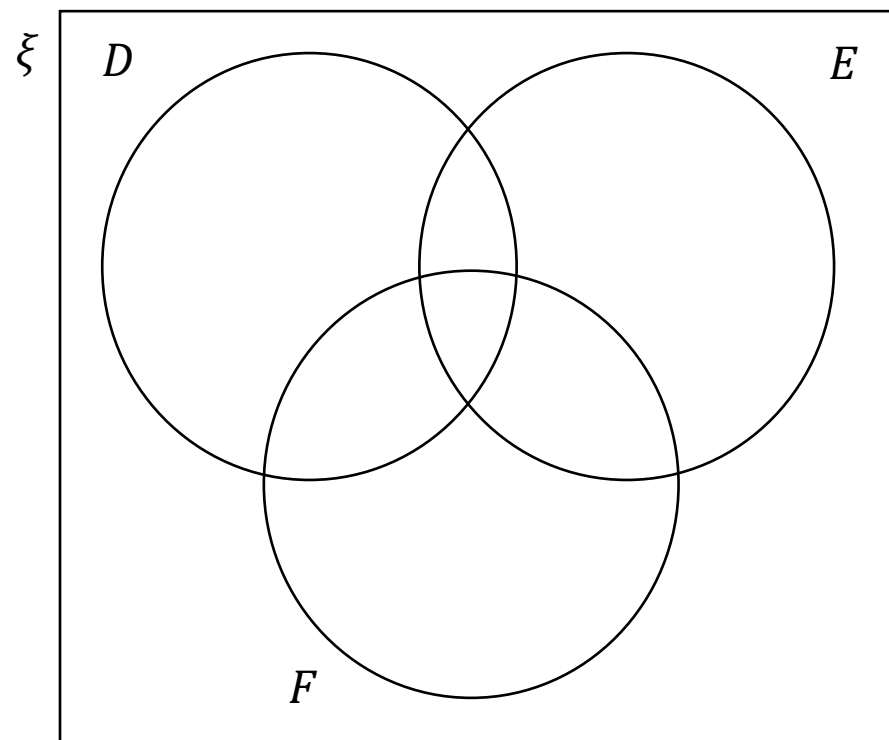
$$A' \cap B \cap C$$



Worked example

On the Venn diagram, shade the region representing:

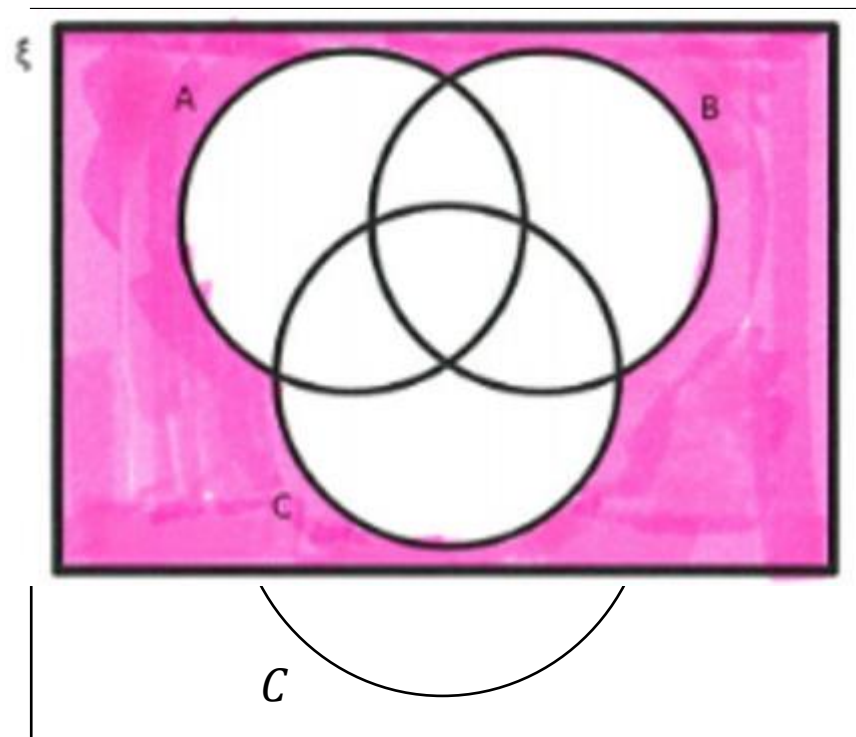
$$(D \cup E \cup F)'$$



Your turn

On the Venn diagram, shade the region representing:

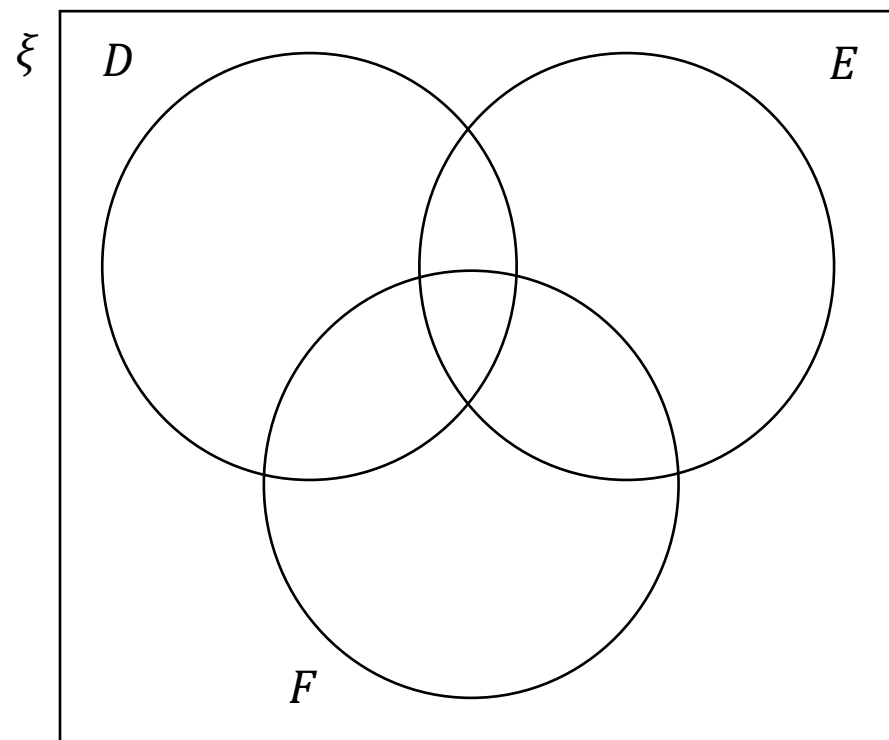
$$(A \cup B \cup C)'$$



Worked example

On the Venn diagram, shade the region representing:

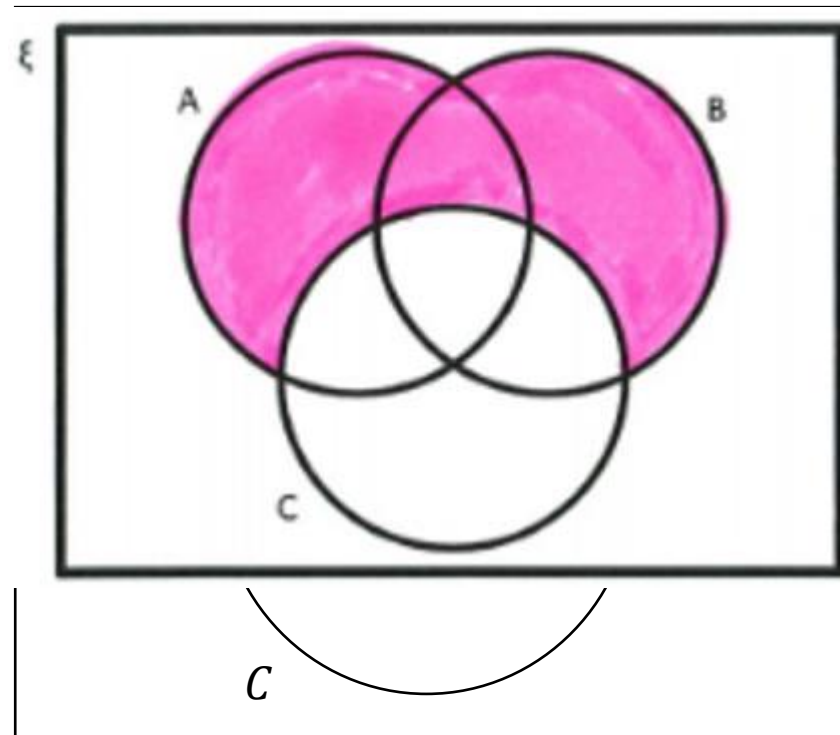
$$(D \cup E) \cap F'$$



Your turn

On the Venn diagram, shade the region representing:

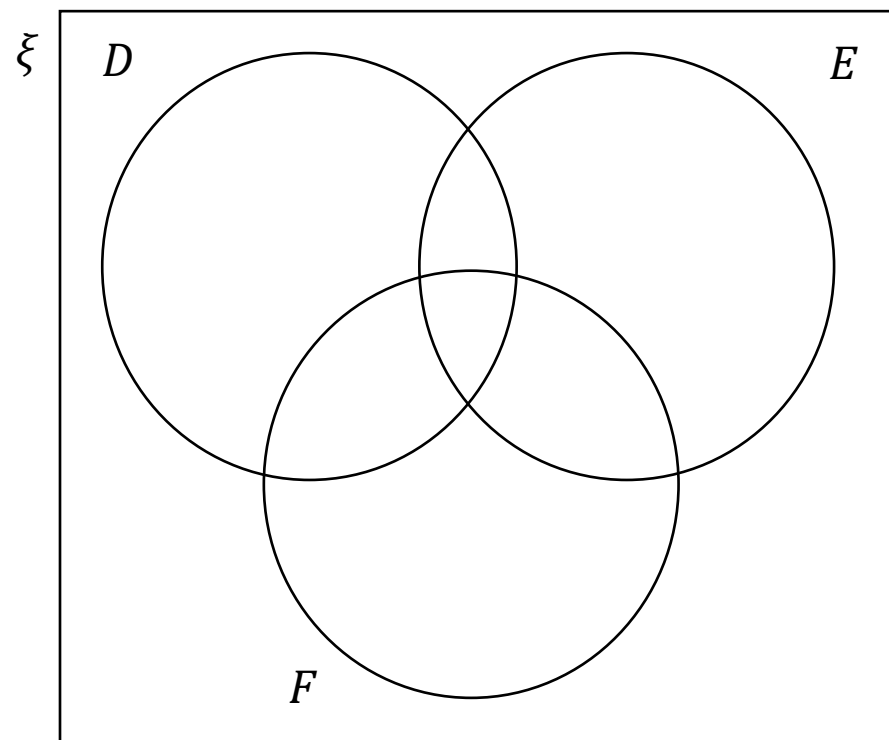
$$(A \cup B) \cap C'$$



Worked example

On the Venn diagram, shade the region representing:

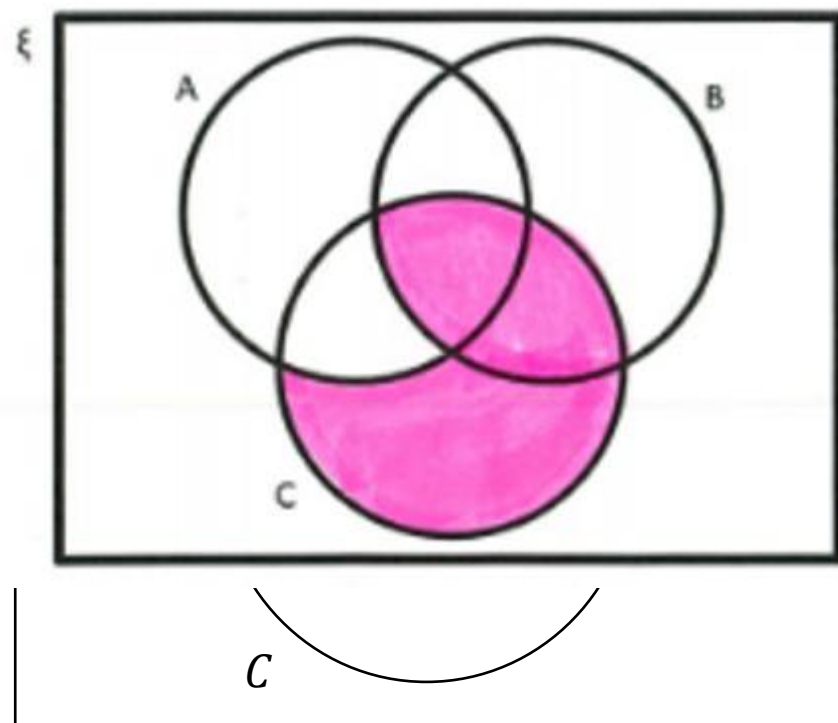
$$(D \cap F) \cup (E \cap F')$$



Your turn

On the Venn diagram, shade the region representing:

$$(B \cap C) \cup (A' \cap C)$$

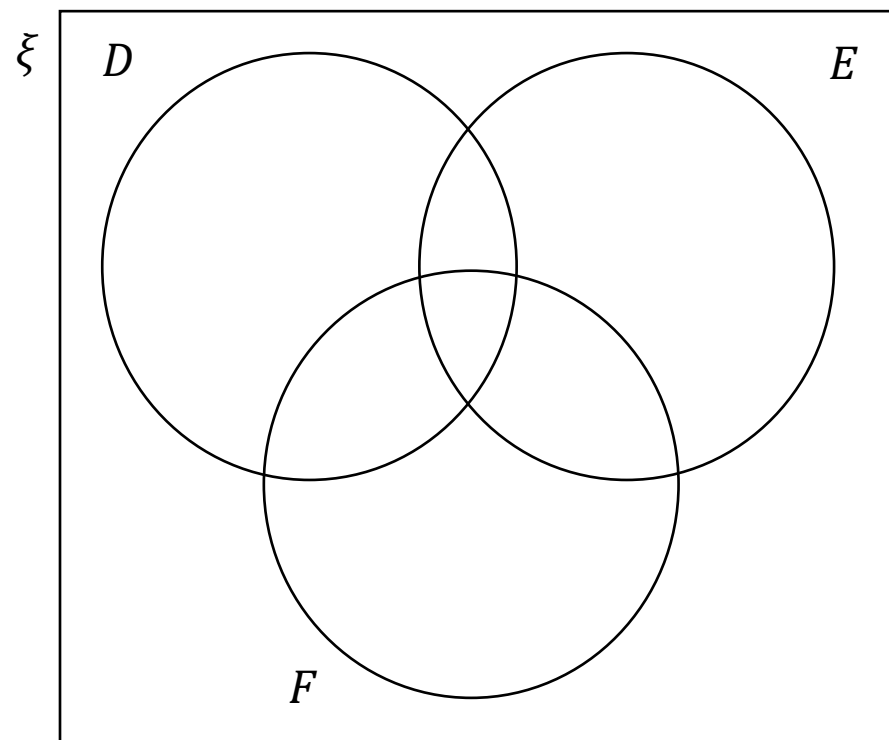


Worked example

On the Venn diagram, shade the region representing:

$$(D' \cup F) \cap (D \cup E')$$

$$(A' \cup B) \cap (B' \cup C)$$



Your turn

On the Venn diagram, shade the region representing:

$$(A' \cup B) \cap (B' \cup C)$$

