2.1) Set notation

Worked example	Your turn
A card is selected at random from a pack of 52 playing cards. Let R be the event that the card is a royal (king, queen or jack). Let S be the event that the card is a spade. Find: a) $P(R \cap S)$ b) $P(R \cup S)$ c) $P(R')$ d) $P(R' \cap S)$	A card is selected at random from a pack of 52 playing cards. Let A be the event that the card is an ace. Let D be the event that the card is a diamond. Find: a) $P(A \cap D)$ b) $P(A \cup D)$ c) $P(A')$ d) $P(A' \cap D)$ a) $\frac{1}{52}$ b) $\frac{16}{52}$ c) $\frac{48}{52}$ d) $\frac{12}{52}$

Worked example	Your turn
Given that: $$P(A) = 0.5$$ $$P(B) = 0.2$$ $$P(A \cap B) = 0.1$$ Explain why events A and B are independent	Given that: $$P(A) = 0.3$$ $$P(B) = 0.4$$ $$P(A \cap B) = 0.25$$ Explain why events A and B are not independent. If independent $P(A) \times P(B) = P(A \cap B)$ $$0.3 \times 0.4 = 0.12 \neq 0.25$$ $\therefore$ A and B are not independent.

Worked example	Your turn

Worked example

Given that:

$$P(A) = 0.5$$
$$P(B) = 0.34$$
$$P(A \cap B) = 0.25$$
$$P(C) = 0.15$$

A and C are mutually exclusive.
Events B and C are independent.

a) Draw a Venn diagram to illustrate the events A, B and C, showing the probabilities for each region.

b) Find $P\big((C \cap B') \cup A\big)$

Your turn

Given that:

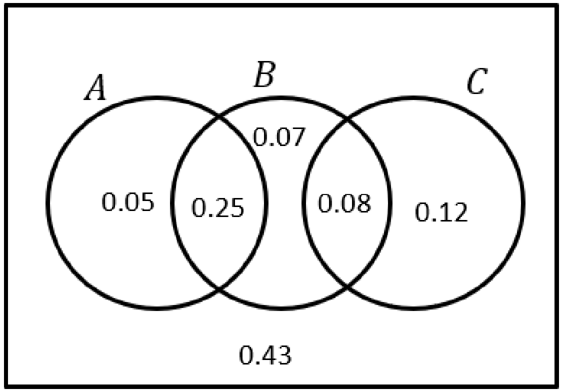
$$P(A) = 0.3$$
$$P(B) = 0.4$$
$$P(A \cap B) = 0.25$$
$$P(C) = 0.2$$

A and C are mutually exclusive.
Events B and C are independent.

a) Draw a Venn diagram to illustrate the events A, B and C, showing the probabilities for each region.

b) Find $P\big((A \cap B') \cup C\big)$

a)

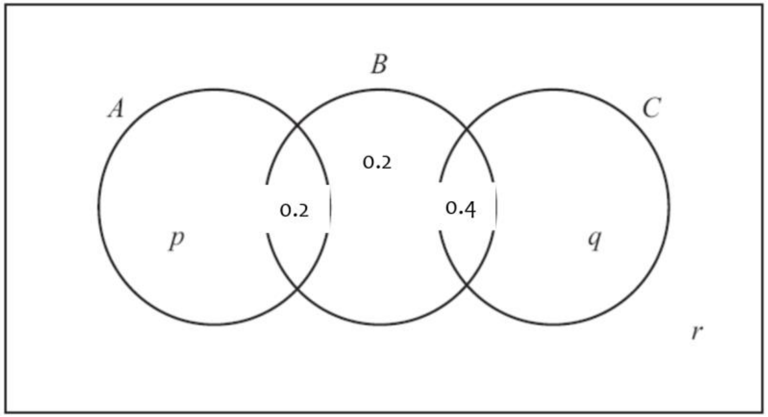


b) 0.25

Worked example

The events A and B are independent.

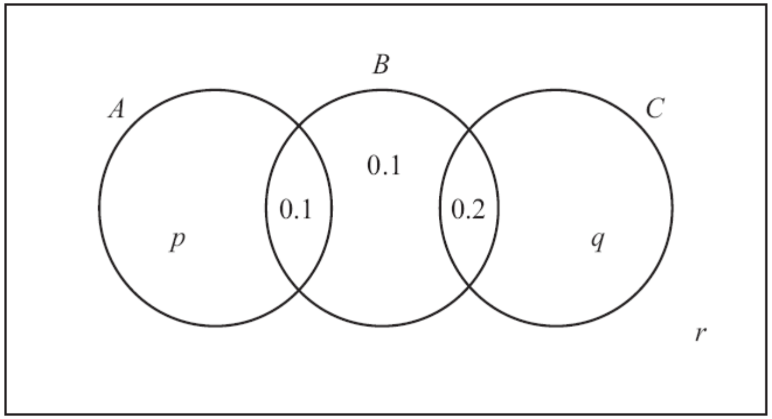
Find the value of p.



Your turn

The events A and B are independent.

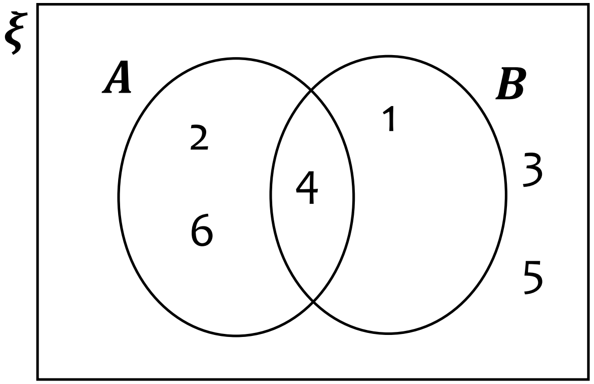
Find the value of p.



$p = 0.15$

Worked example	Your turn
Events A and B are independent. $$P(A) = x$$ $$P(B) = y$$ Find: a) $P(A \cup B)$ b) $P(A' \cup B)$	Events A and B are independent. $$P(A) = x$$ $$P(B) = y$$ Find: a) $P(A \cap B)$ b) $P(A \cup B')$ a) xy b) $1 - y + xy$

Worked example

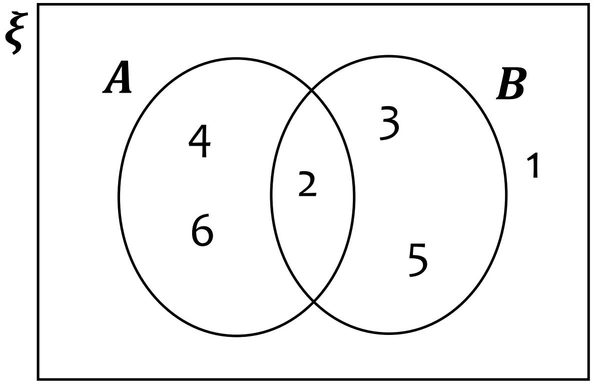


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A'$$

Your turn



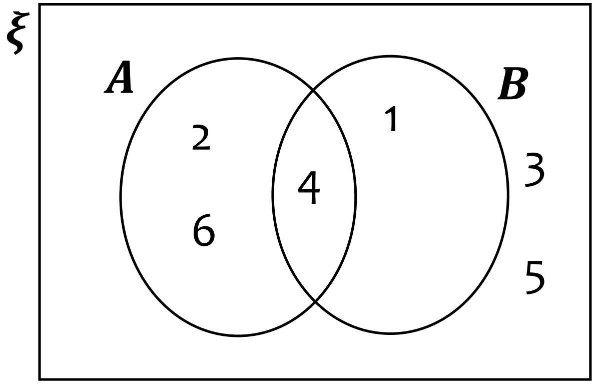
ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A'$$

Not A (the complement of A)
Not rolling an even number
$\{1, 3, 5\}$

Worked example

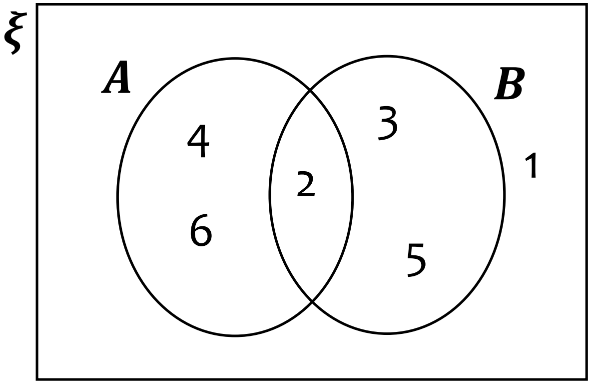


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$B'$$

Your turn



ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

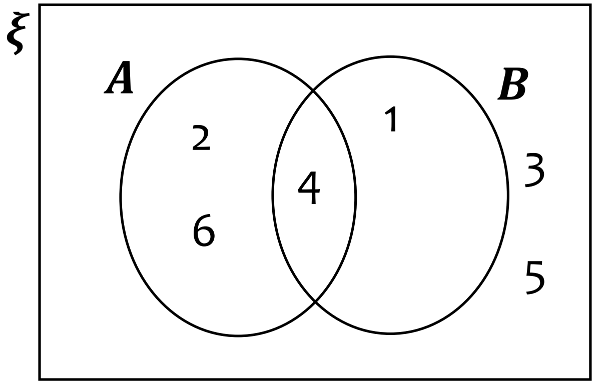
State what it means in this context, and the resulting set of outcomes:

$$B'$$

Not B (the complement of B)
Not rolling a prime number
$\{1, 4, 6\}$

Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

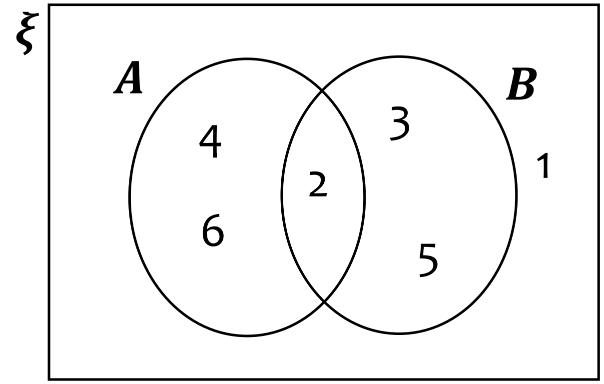
Worked example	Your turn



ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A \cup B$$



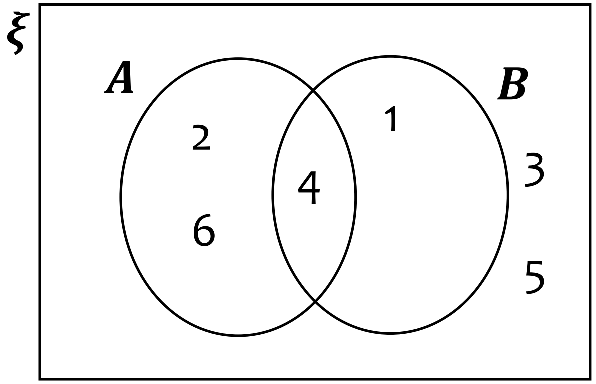
ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A \cup B$$

A or B (the union of A and B)
Rolling an even number or a prime number
$\{2, 3, 4, 5, 6\}$

Worked example

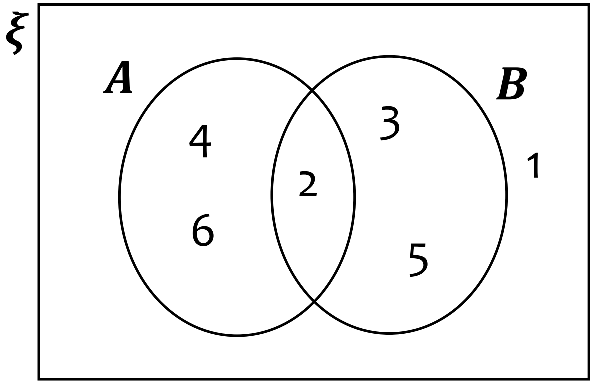


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A \cap B$$

Your turn



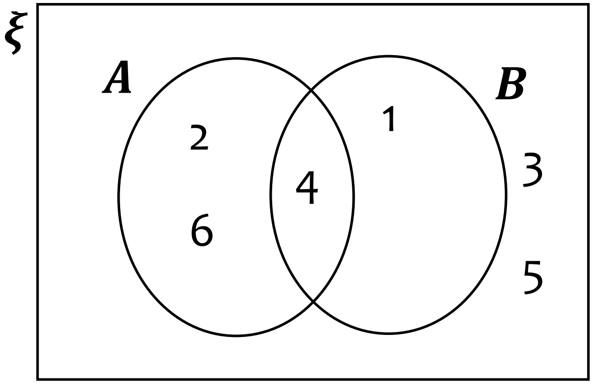
ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A \cap B$$

A and B (the intersection of A and B)
Rolling a number which is even and prime
{2}

Worked example

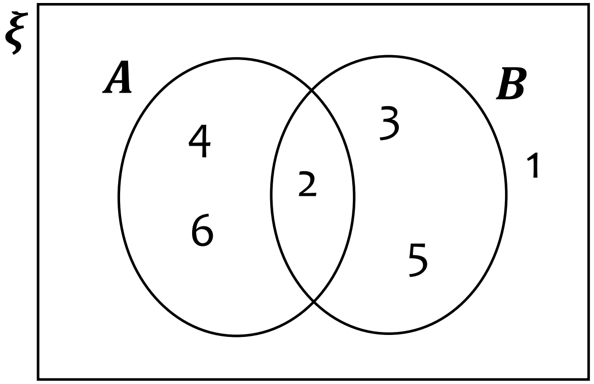


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A \cap B'$$

Your turn



ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

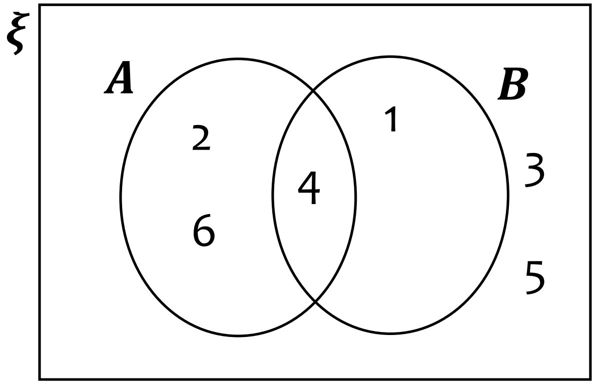
State what it means in this context, and the resulting set of outcomes:

$$A \cap B'$$

A and not B
Rolling a number which is even and not prime
$\{4,6\}$

Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

Worked example



ξ = the whole sample space (1 to 6)

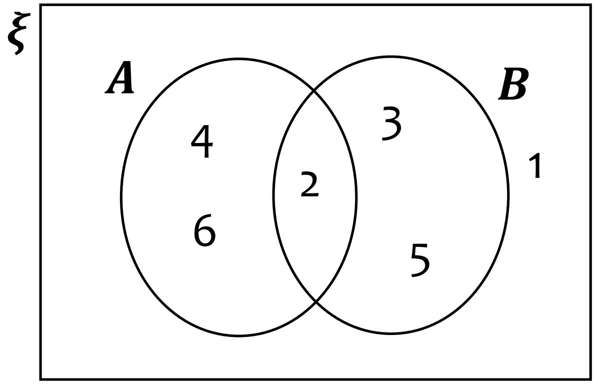
A = even number on a die thrown

B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$A' \cap B$$

Your turn



ξ = the whole sample space (1 to 6)

A = even number on a die thrown

B = prime number on a die thrown

State what it means in this context, and the resulting set of outcomes:

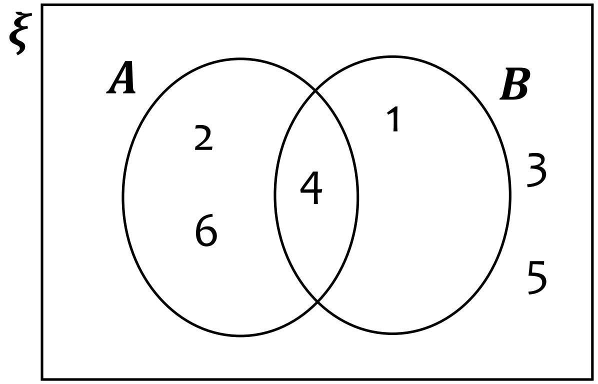
$$A' \cap B$$

B and not A

Rolling a number which is prime and not even

$\{3, 5\}$

Worked example

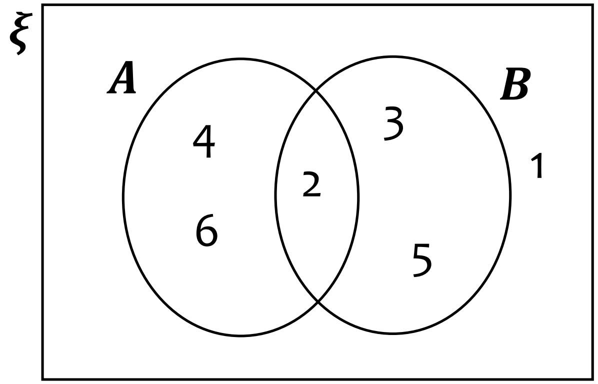


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$(A \cup B)'$$

Your turn



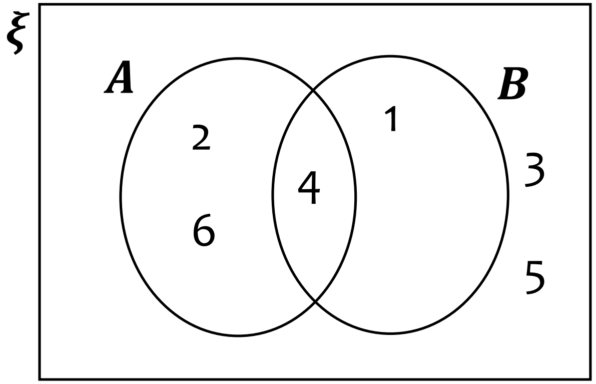
ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$(A \cup B)'$$

Not (A or B)
Rolling a number which is not (even or prime)
$\{1\}$

Worked example

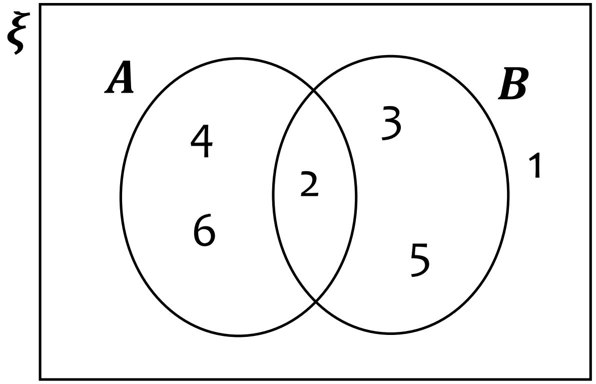


ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = square number on a die thrown

State what it means in this context, and the resulting set of outcomes:

$$(A \cap B)'$$

Your turn



ξ = the whole sample space (1 to 6)
A = even number on a die thrown
B = prime number on a die thrown

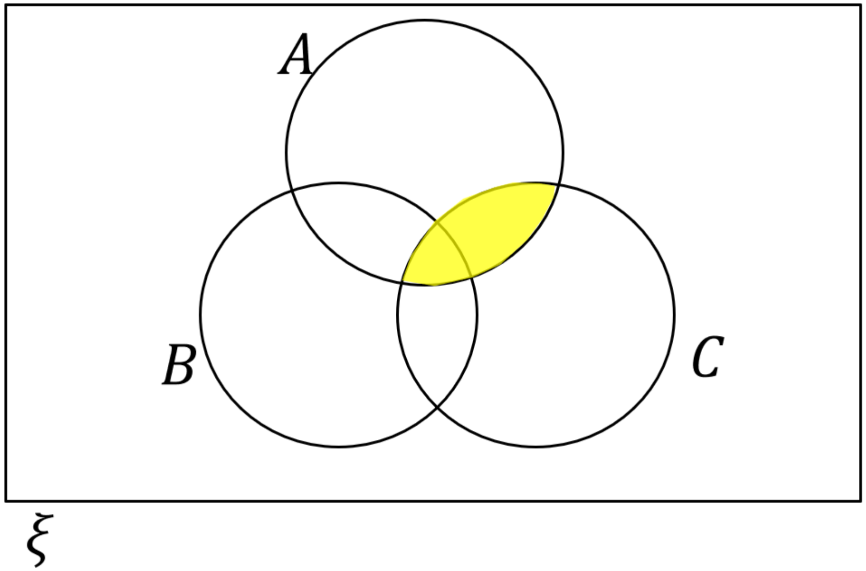
State what it means in this context, and the resulting set of outcomes:

$$(A \cap B)'$$

Not (A and B)
Rolling a number which is not (even and prime)
$\{1\}$

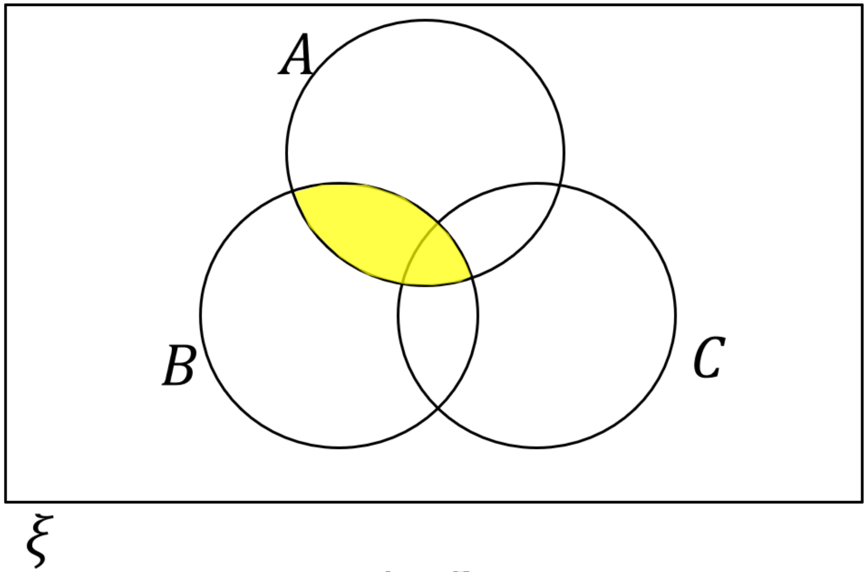
Worked example

Describe the area indicated using set notation:



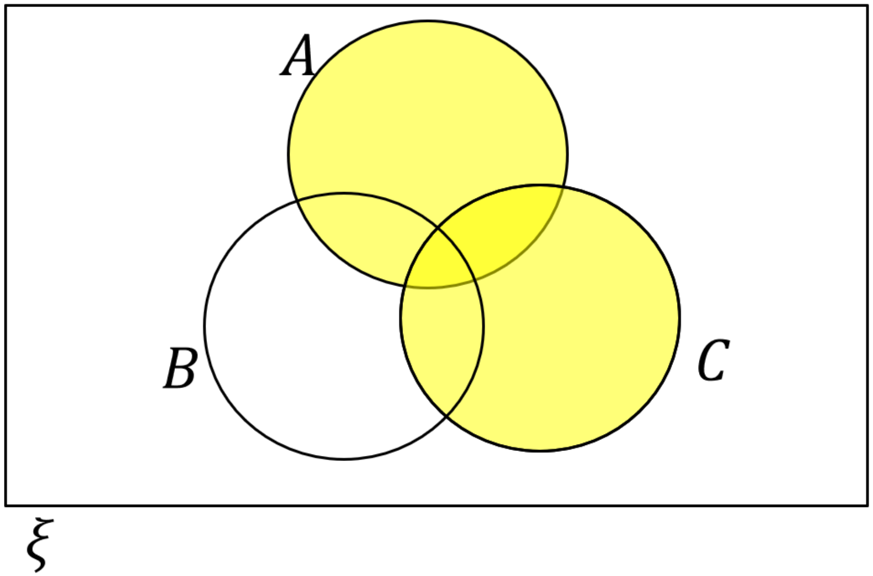
Your turn

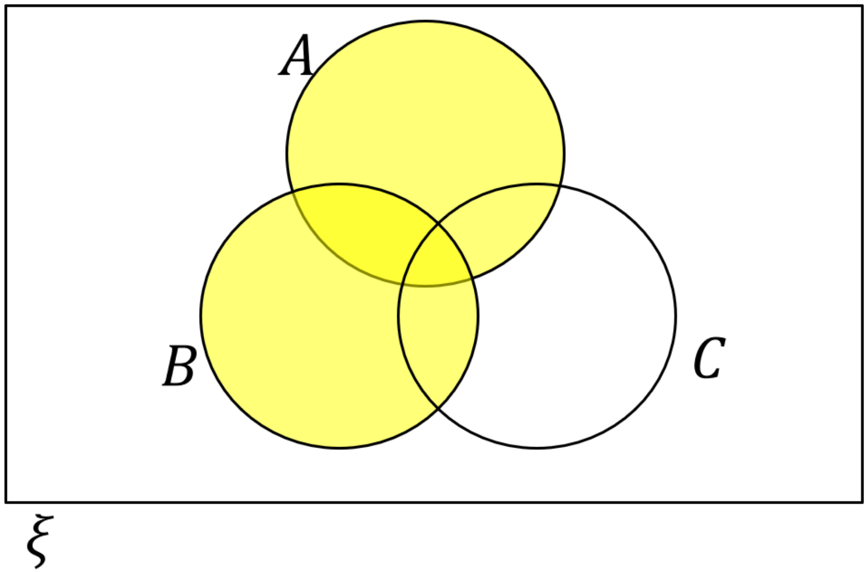
Describe the area indicated using set notation:



$A \cap B$

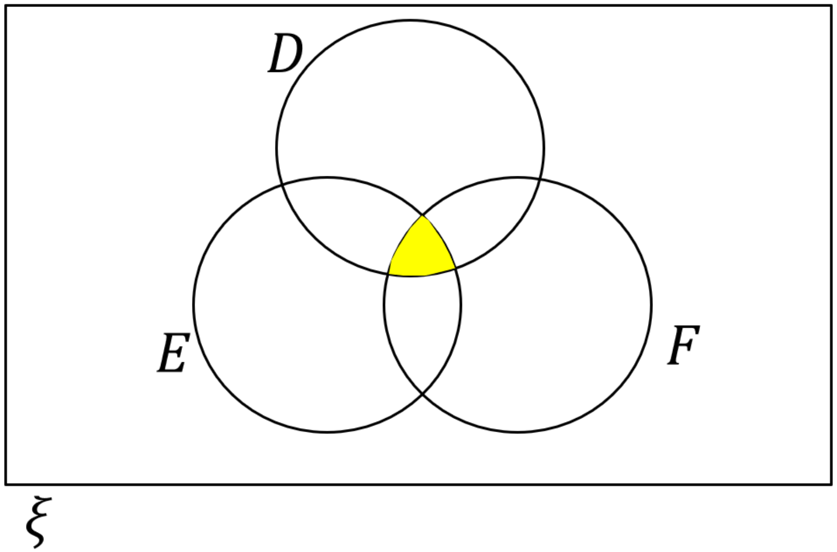
Worked example	Your turn
Describe the area indicated using set notation:	Describe the area indicated using set notation:

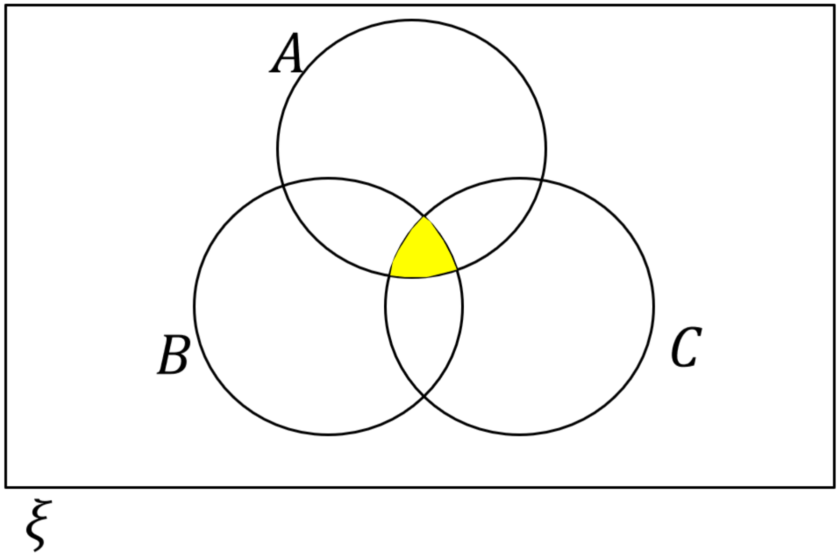




$A \cup B$

Worked example	Your turn
Describe the area indicated using set notation:	Describe the area indicated using set notation:

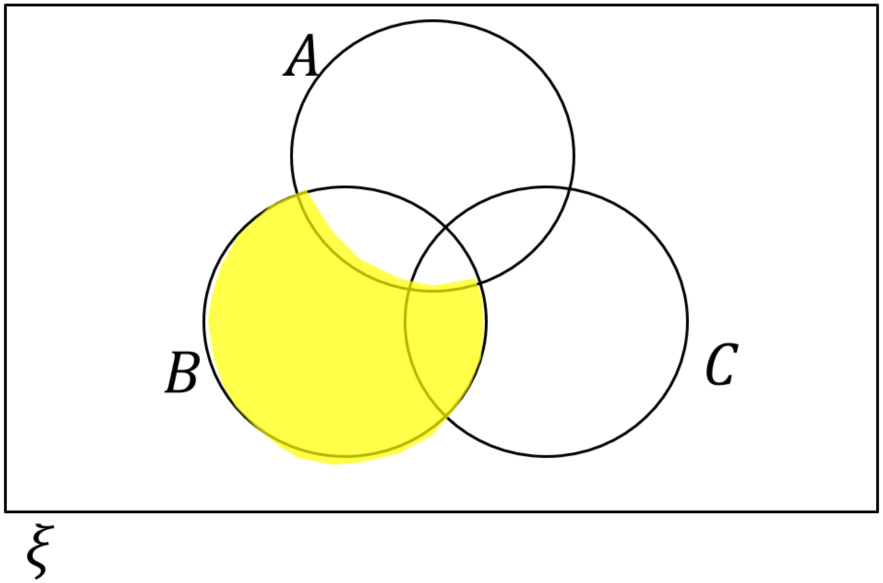




$A \cap B \cap C$

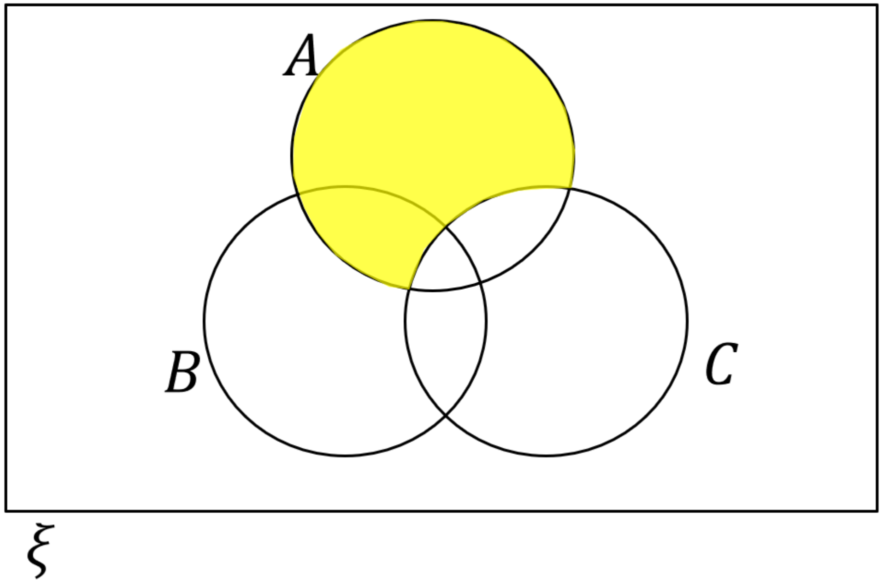
Worked example

Describe the area indicated using set notation:

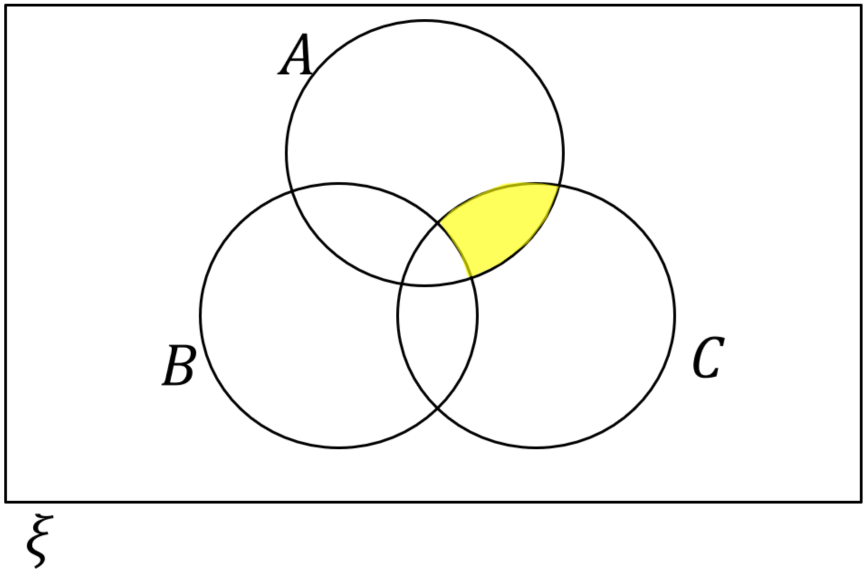
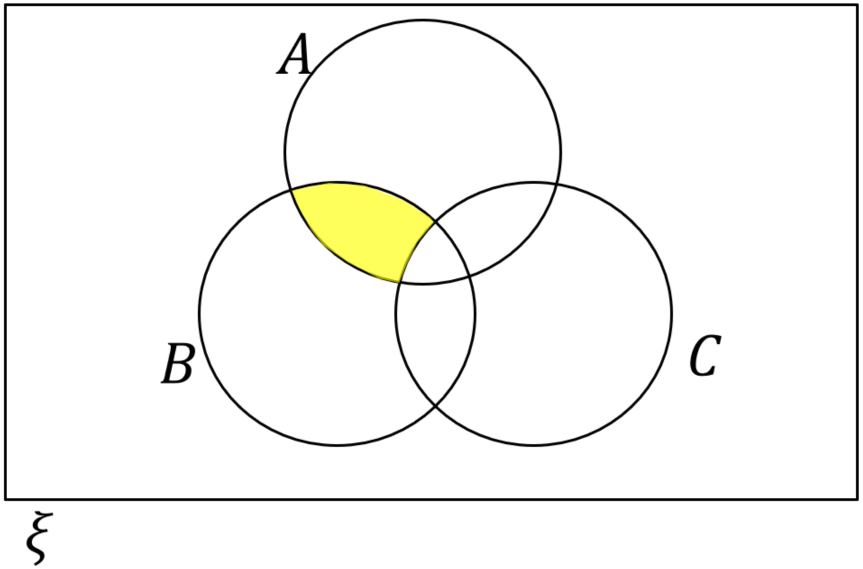


Your turn

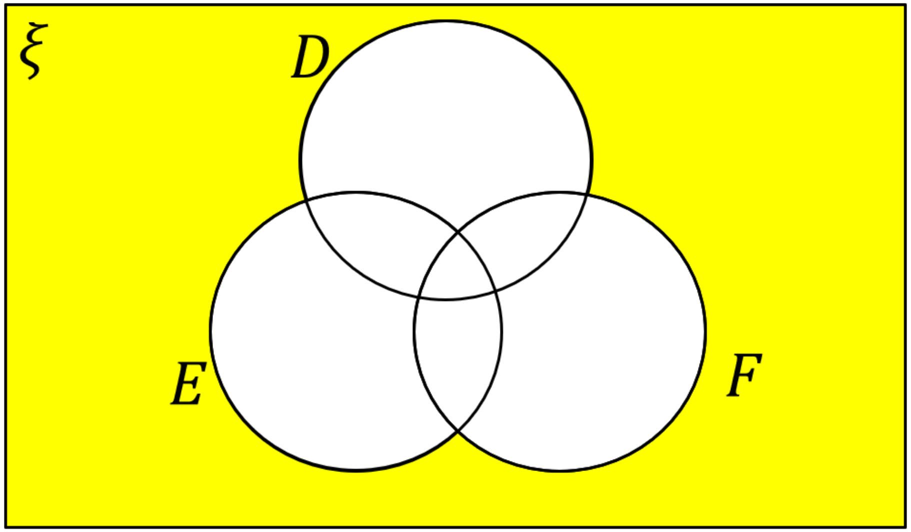
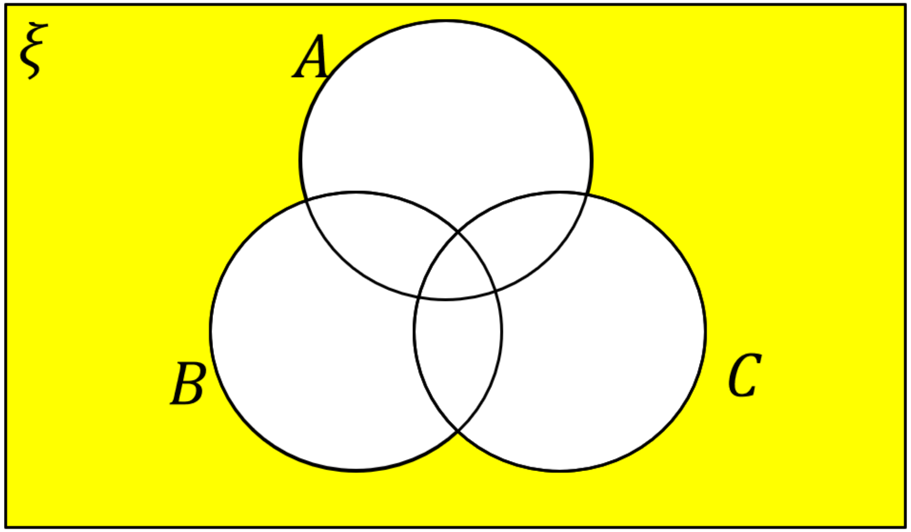
Describe the area indicated using set notation:

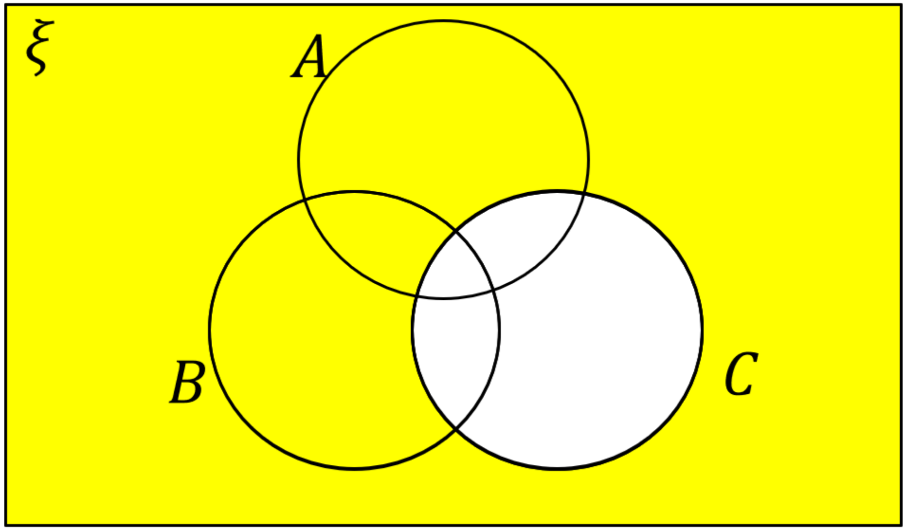
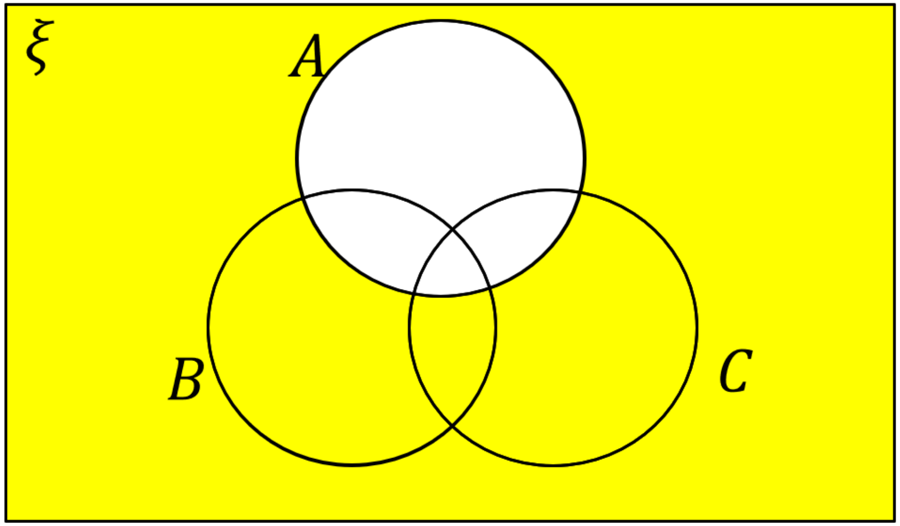


$A \cap C'$

Worked example	Your turn
Describe the area indicated using set notation:	Describe the area indicated using set notation:
	
	$A \cap B \cap C'$

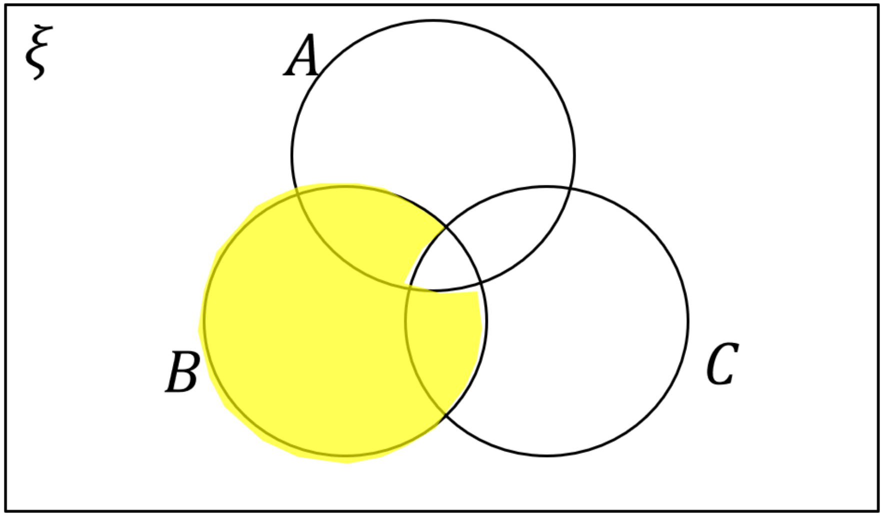
Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

Worked example	Your turn
Describe the area indicated using set notation:	Describe the area indicated using set notation:
	
	$A' \cap B' \cap C'$ or $(A \cup B \cup C)'$

Worked example	Your turn
Describe the area indicated using set notation: 	Describe the area indicated using set notation:  A'

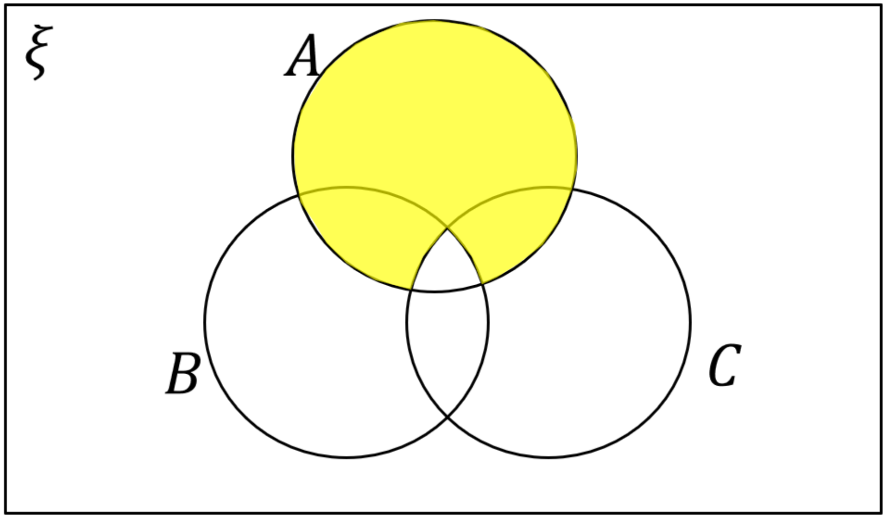
Worked example

Describe the area indicated using set notation:



Your turn

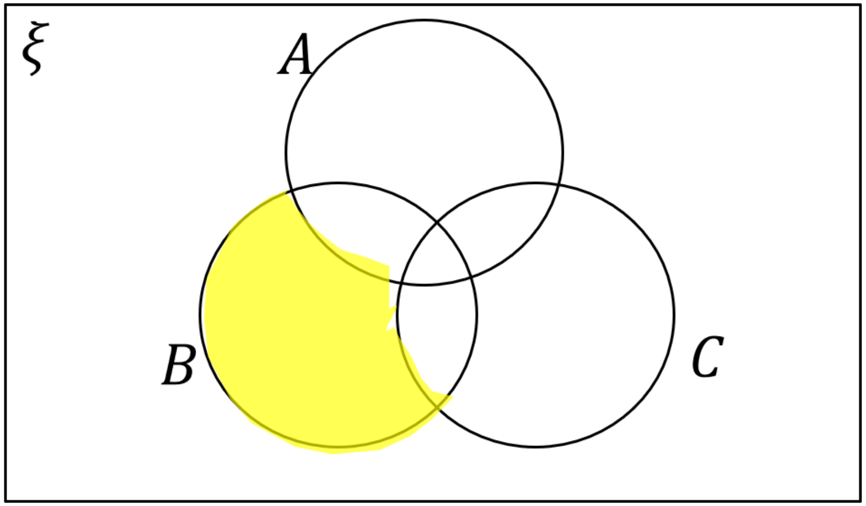
Describe the area indicated using set notation:

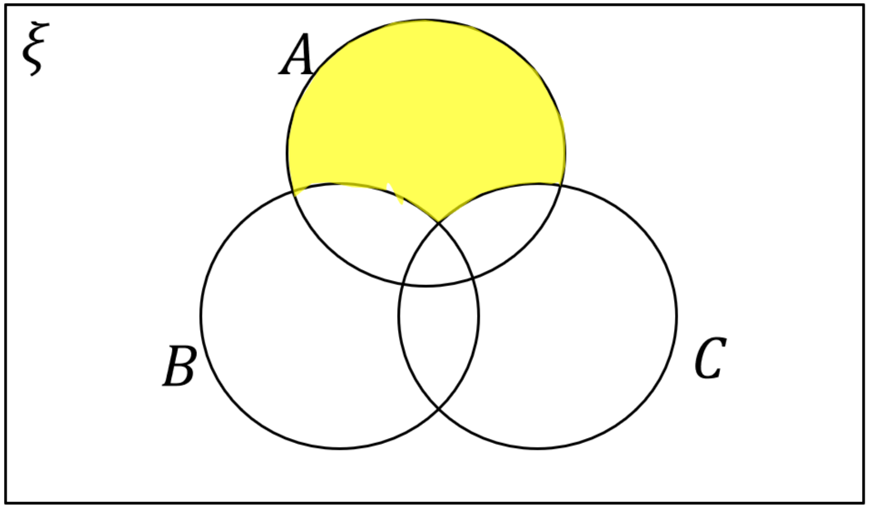


$A \cap (B \cap C)'$

Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

Worked example	Your turn
Describe the area indicated using set notation:	Describe the area indicated using set notation:

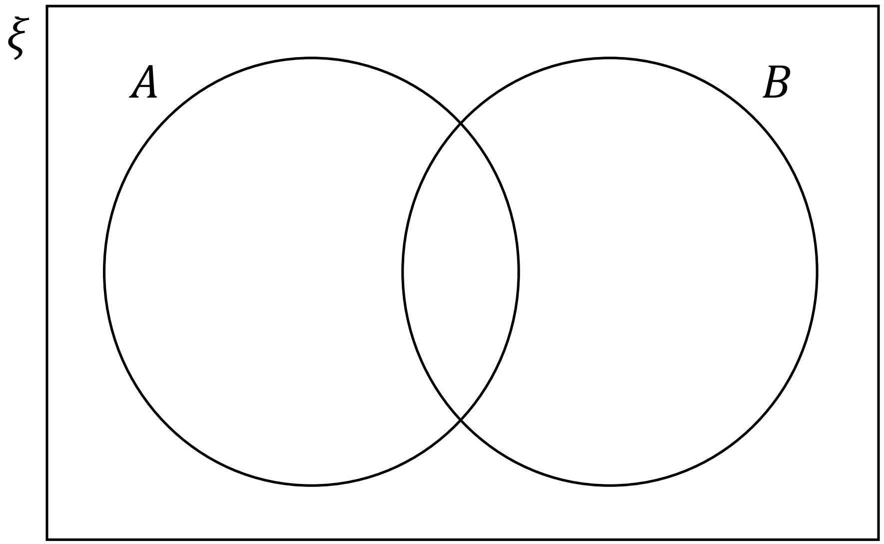


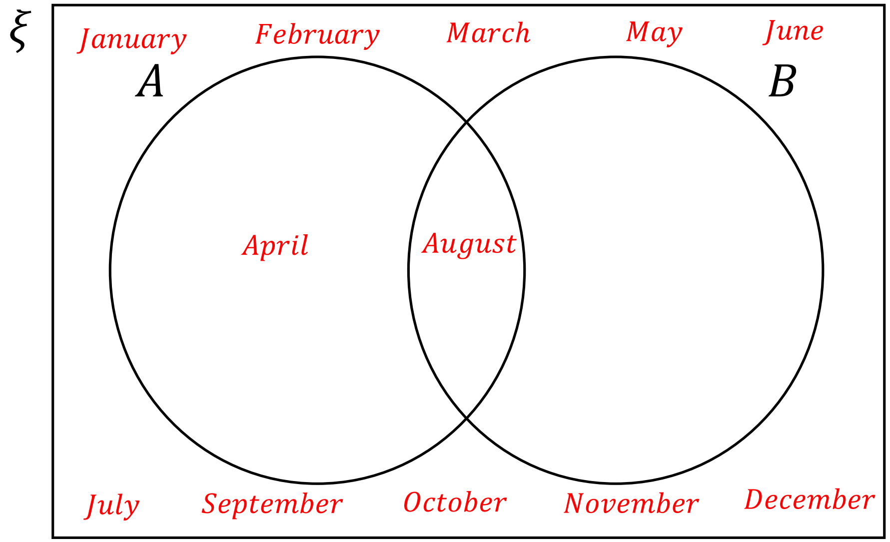


$A \cap B' \cap C'$

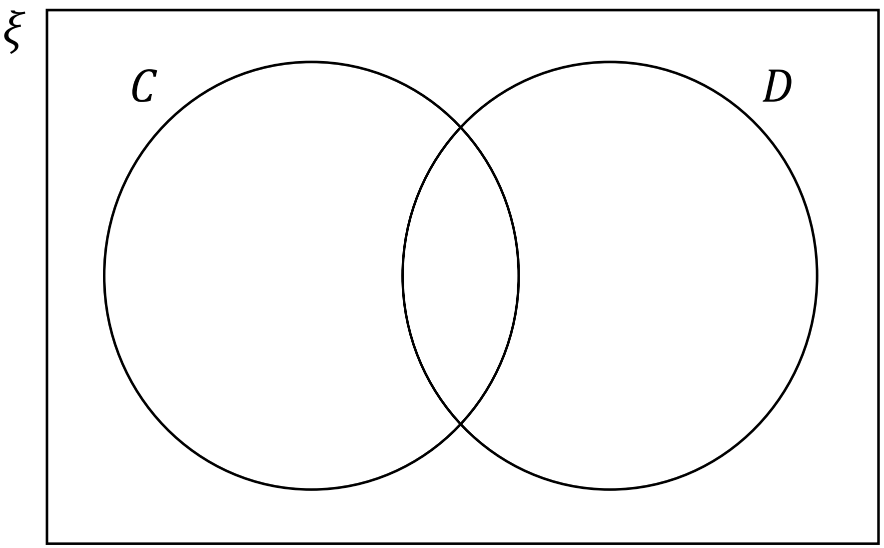
Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

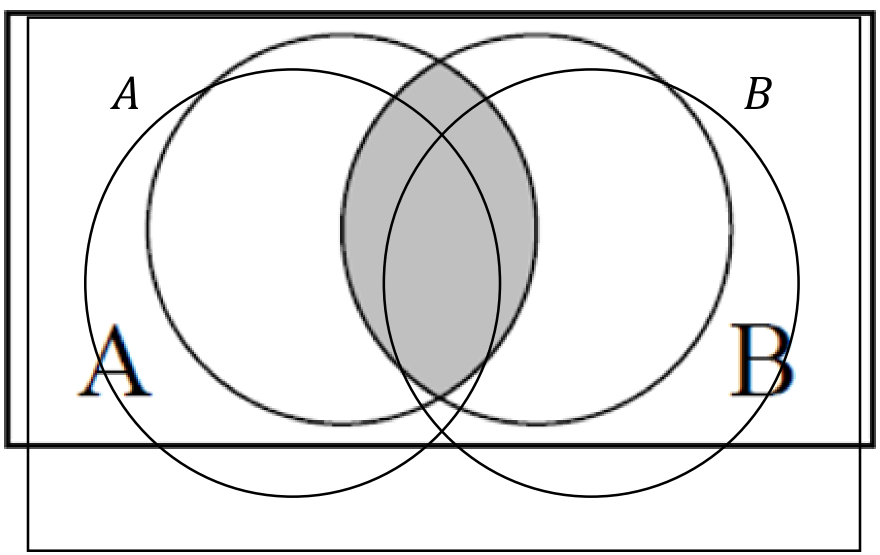
Worked example	Your turn
$\xi = \{Days\ of\ the\ week\}$ $A = \{Tuesday, Thursday\}$ $B = \{Days\ starting\ with\ S\ or\ T\}$ Draw a Venn diagram to represent this information.	$\xi = \{Months\ of\ the\ year\}$ $A = \{Months\ starting\ with\ A\}$ $B = \{Months\ with\ six\ letters\}$ Draw a Venn diagram to represent this information.



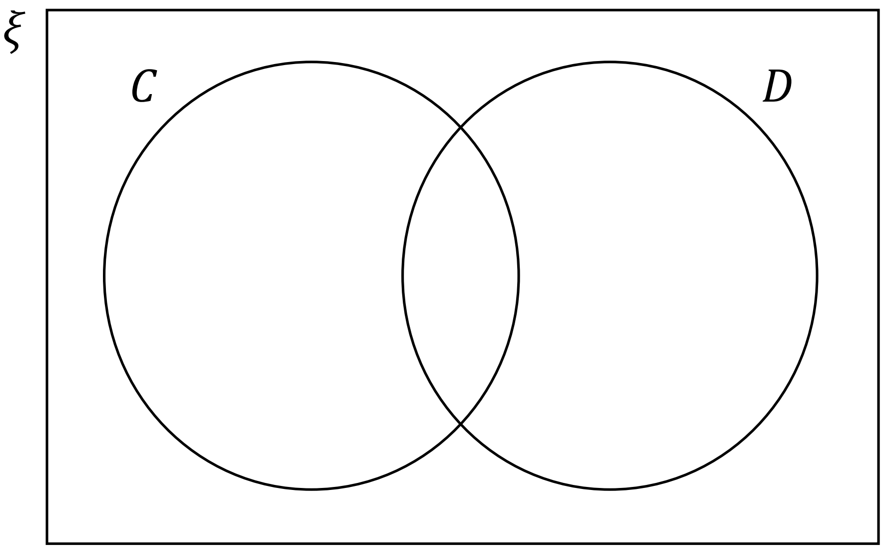


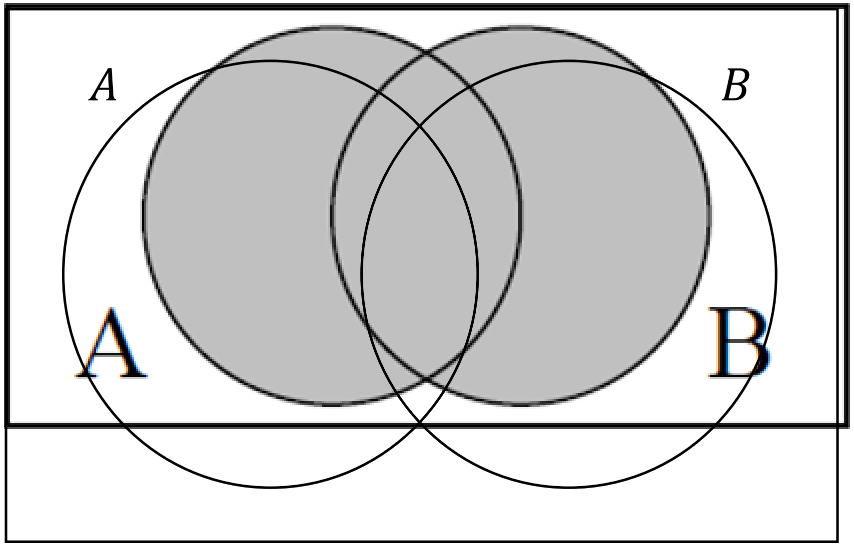
Worked example	Your turn
On the Venn diagram, shade the region representing: $C \cap D$	On the Venn diagram, shade the region representing: $A \cap B$



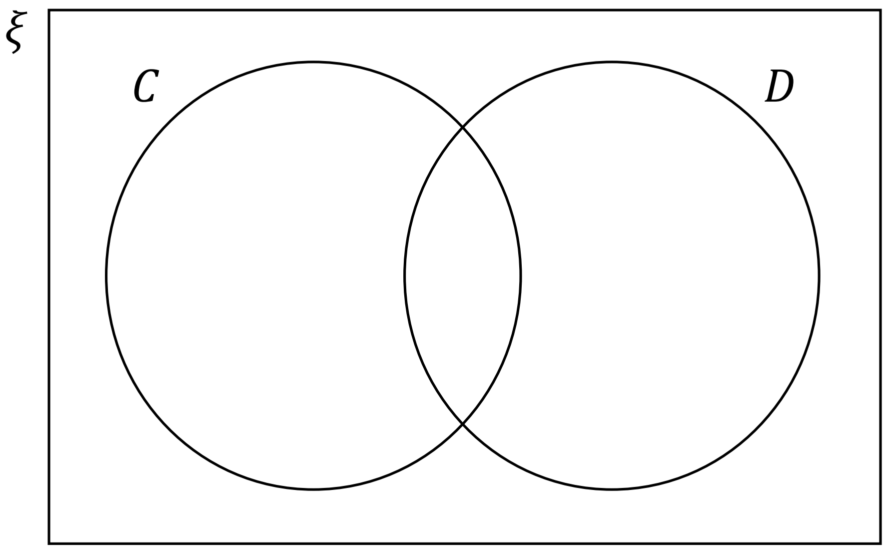


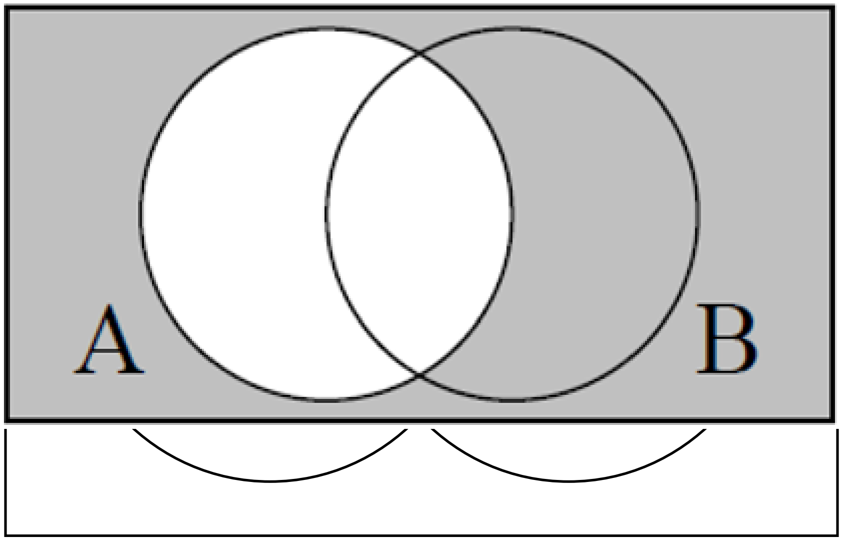
Worked example	Your turn
On the Venn diagram, shade the region representing: $C \cup D$	On the Venn diagram, shade the region representing: $A \cup B$



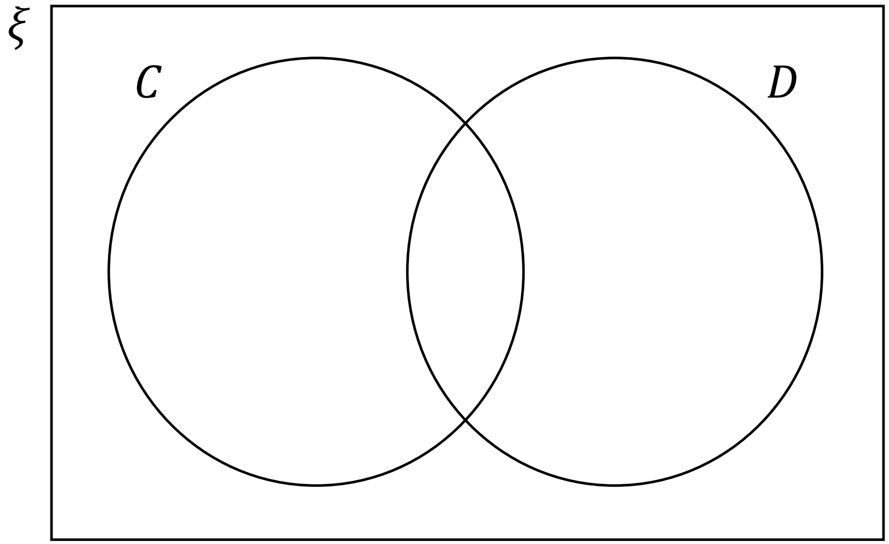


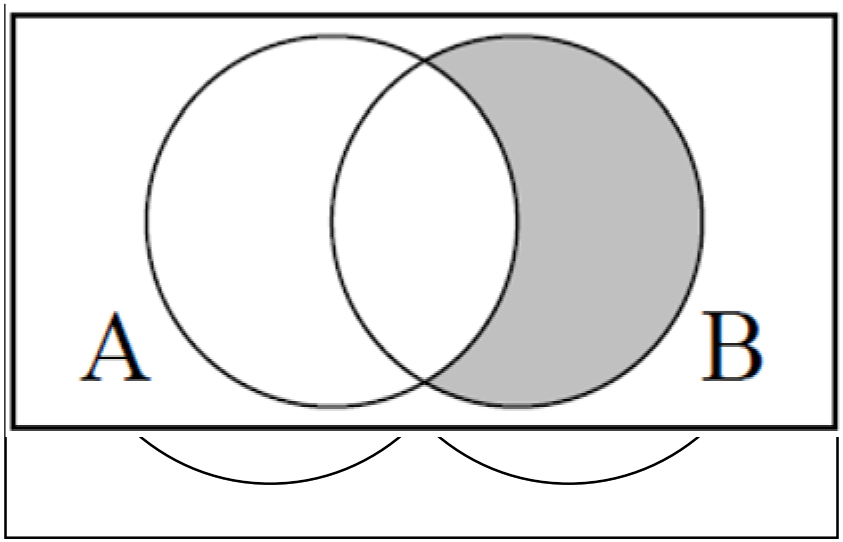
Worked example	Your turn
On the Venn diagram, shade the region representing: D'	On the Venn diagram, shade the region representing: A'



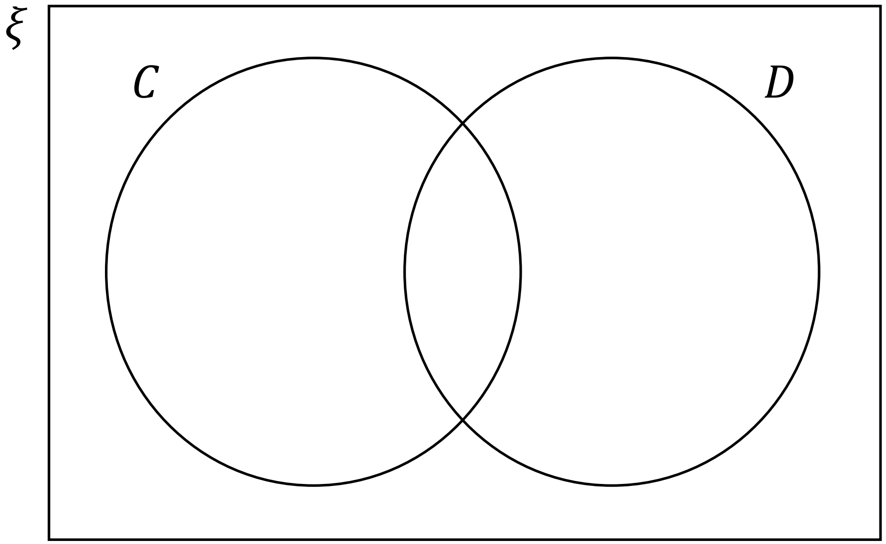


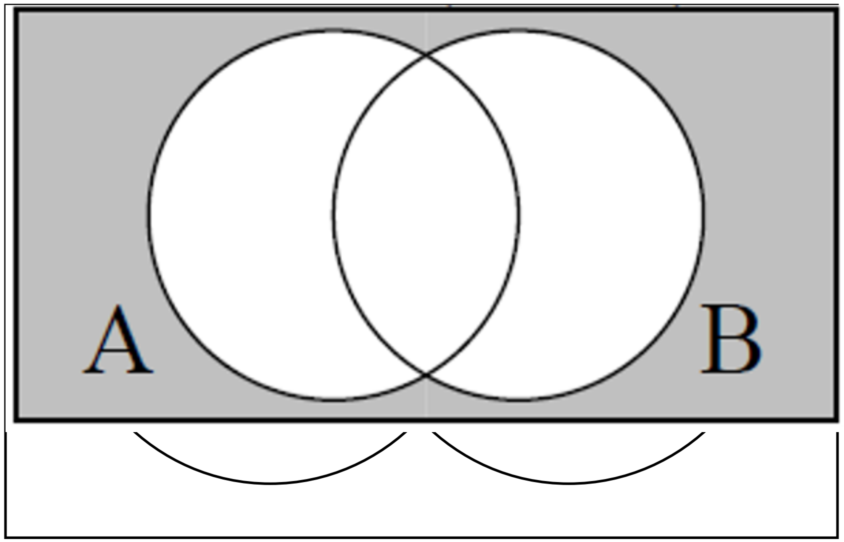
Worked example	Your turn
On the Venn diagram, shade the region representing: $C \cap D'$	On the Venn diagram, shade the region representing: $A' \cap B$





Worked example	Your turn
On the Venn diagram, shade the region representing: $(C \cup D)'$ or $C' \cap D'$	On the Venn diagram, shade the region representing: $(A \cup B)'$ or $A' \cap B'$

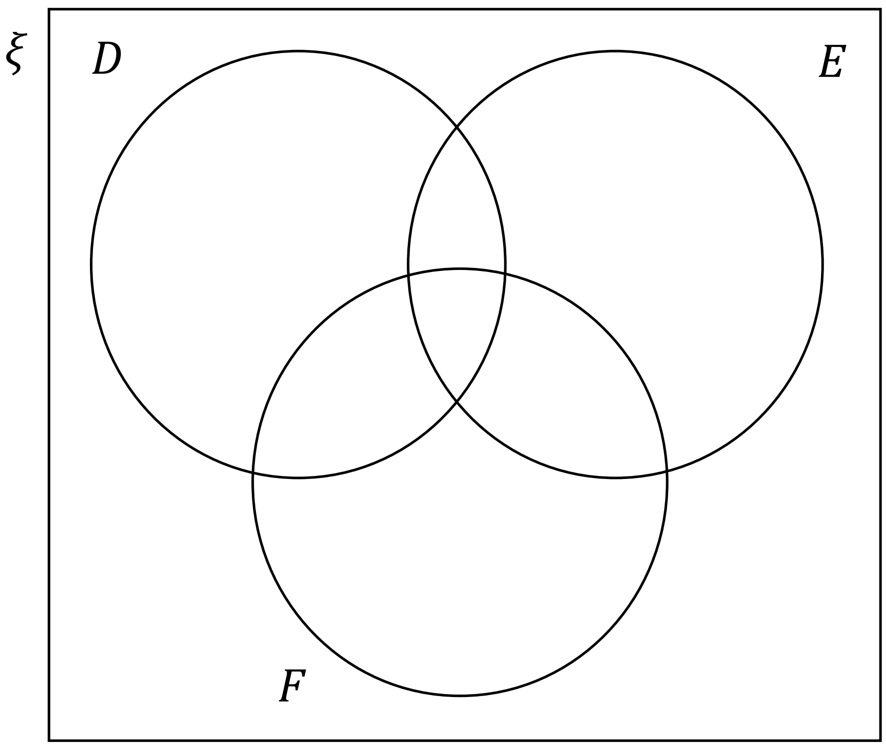




Worked example

On the Venn diagram, shade the region representing:

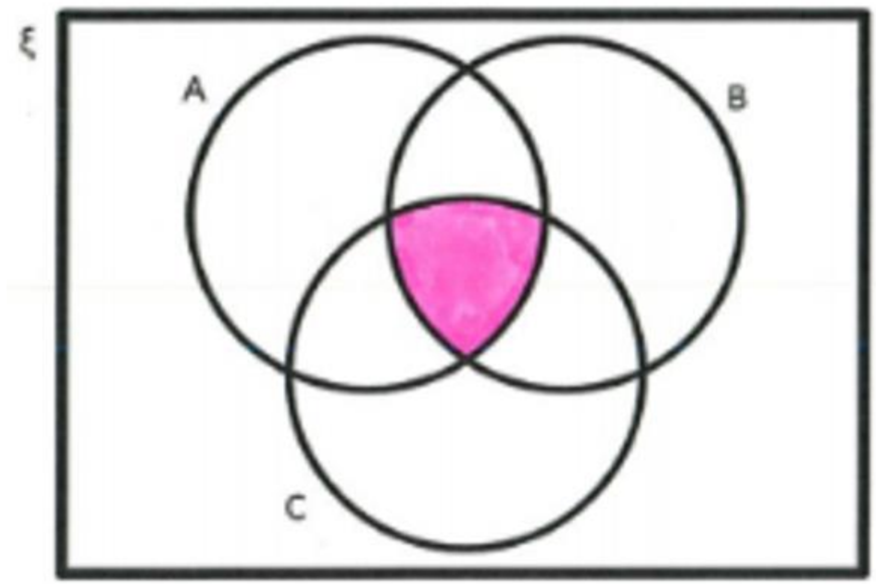
$$D \cap E \cap F$$

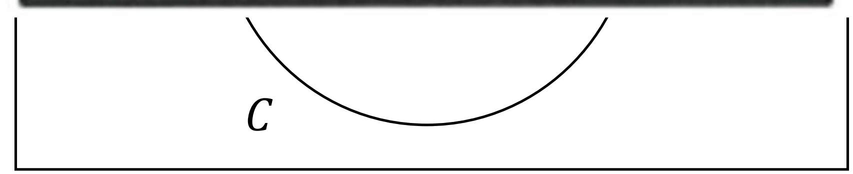


Your turn

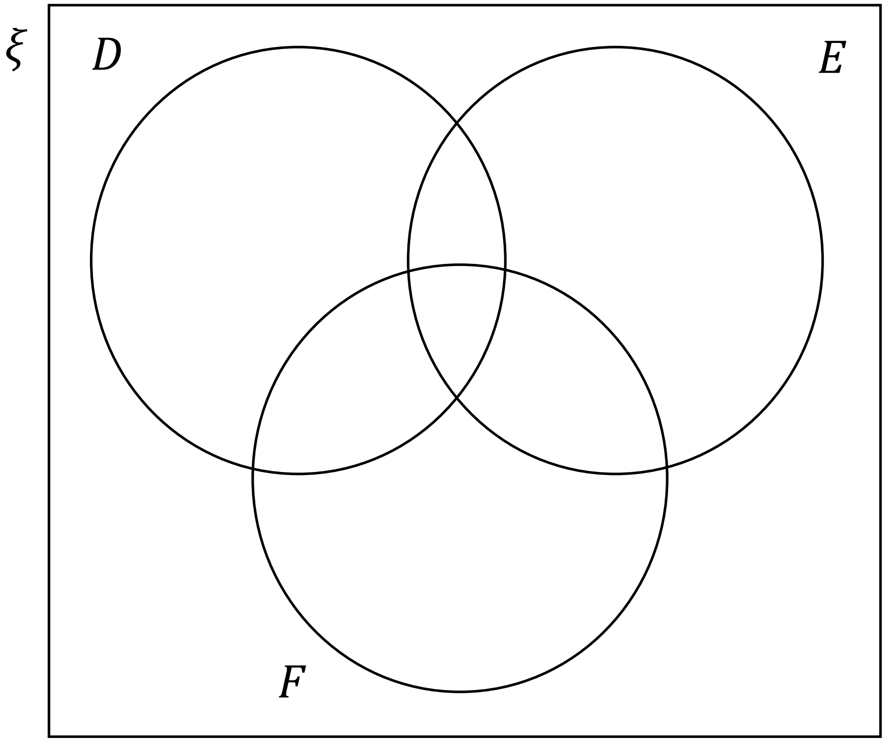
On the Venn diagram, shade the region representing:

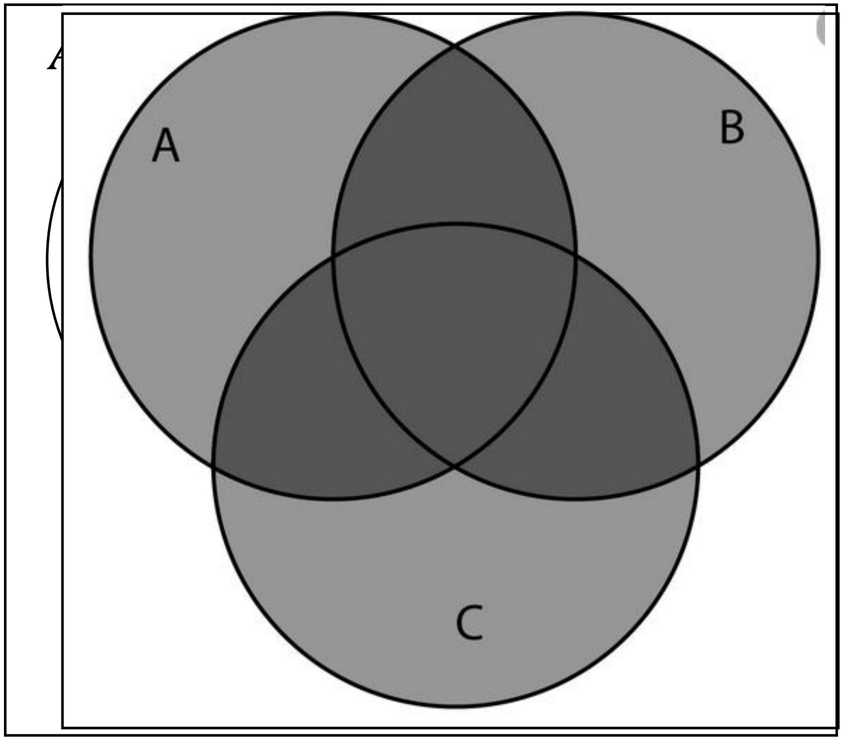
$$A \cap B \cap C$$



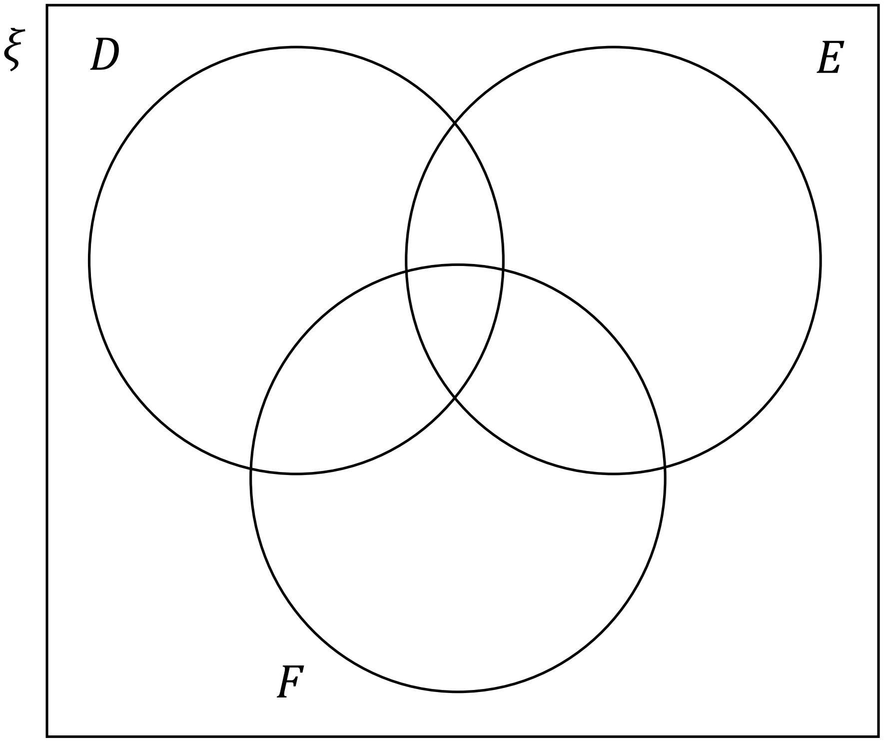


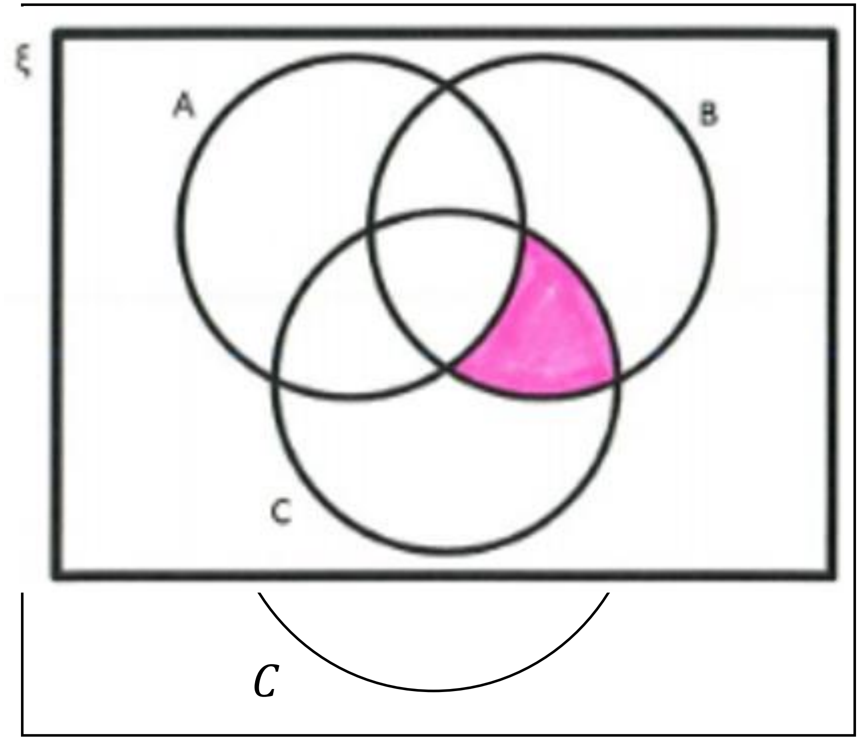
Worked example	Your turn
On the Venn diagram, shade the region representing: $$D \cup E \cup F$$	On the Venn diagram, shade the region representing: $$A \cup B \cup C$$



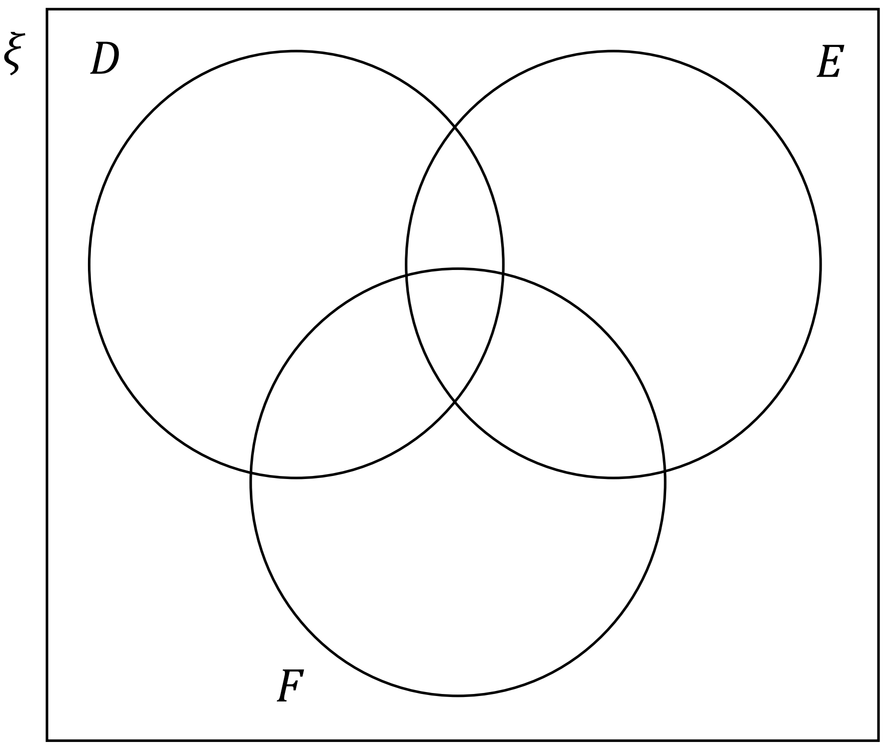


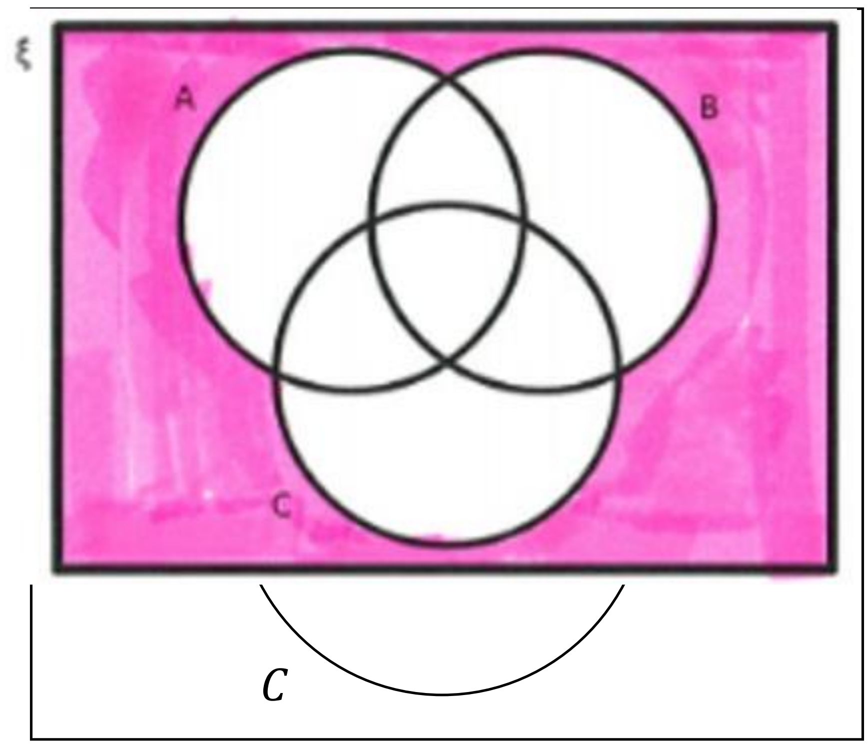
Worked example	Your turn
On the Venn diagram, shade the region representing: $D \cap E' \cap F$	On the Venn diagram, shade the region representing: $A' \cap B \cap C$



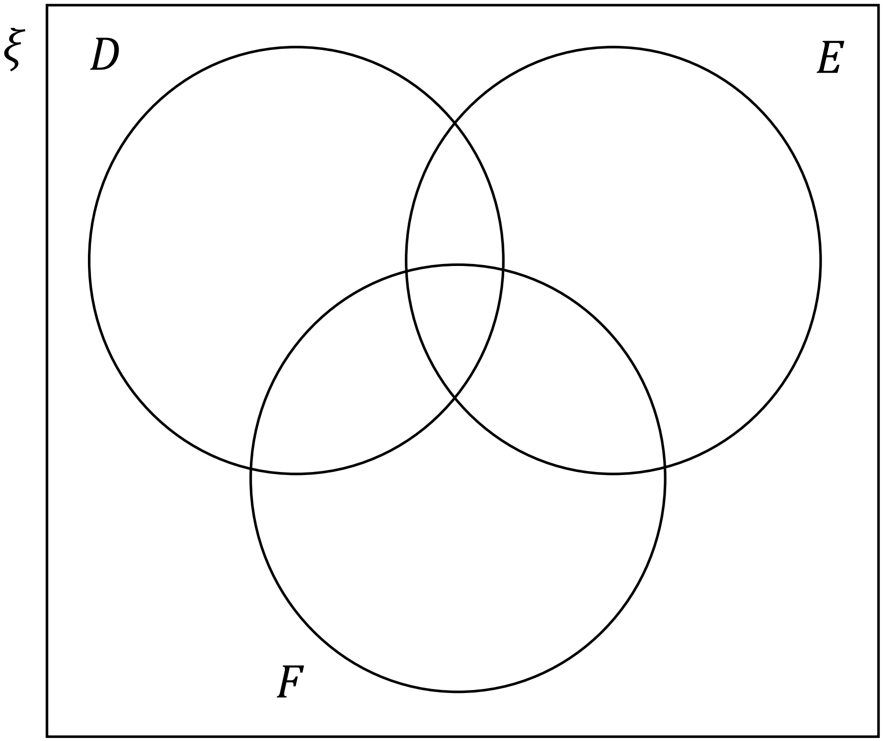


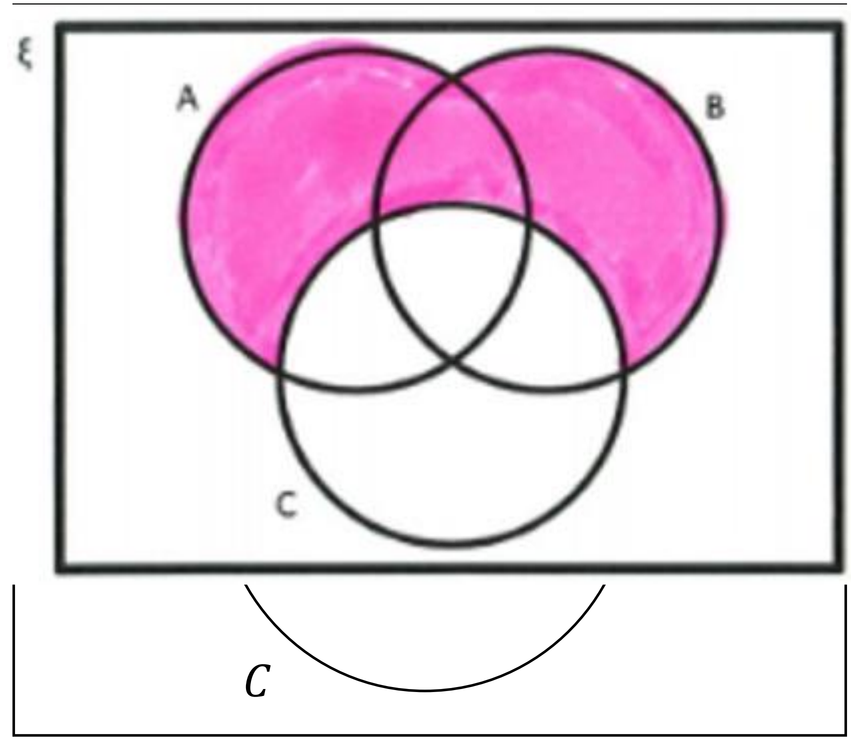
Worked example	Your turn
On the Venn diagram, shade the region representing: $(D \cup E \cup F)'$	On the Venn diagram, shade the region representing: $(A \cup B \cup C)'$



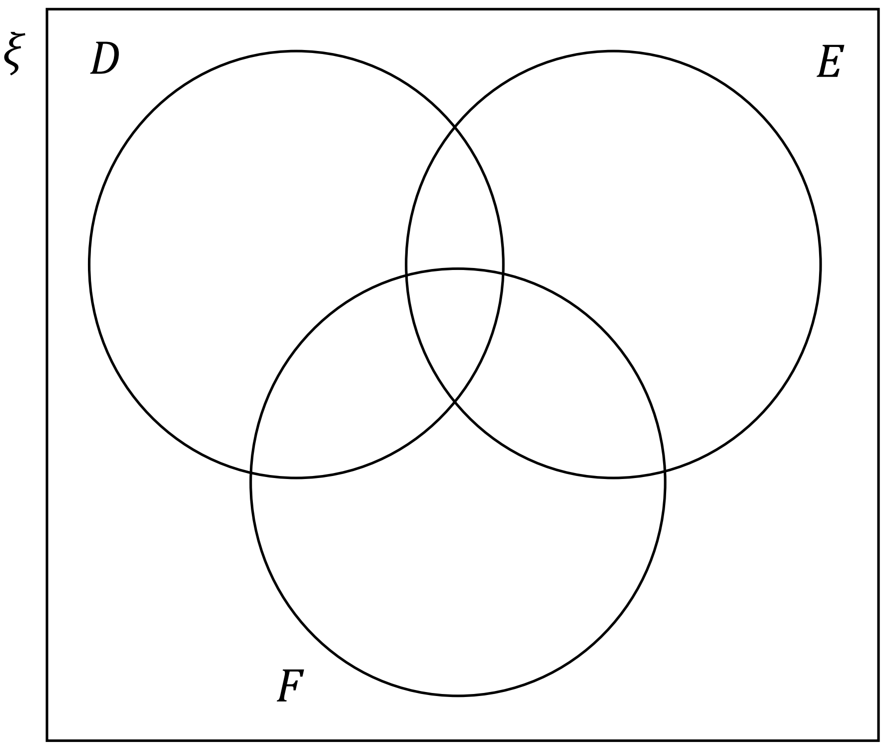


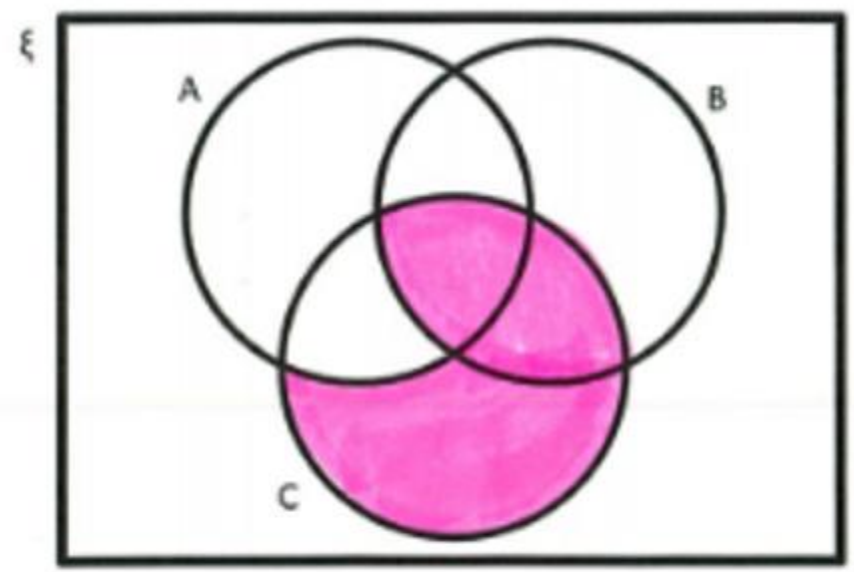
Worked example	Your turn
On the Venn diagram, shade the region representing: $(D \cup E) \cap F'$	On the Venn diagram, shade the region representing: $(A \cup B) \cap C'$

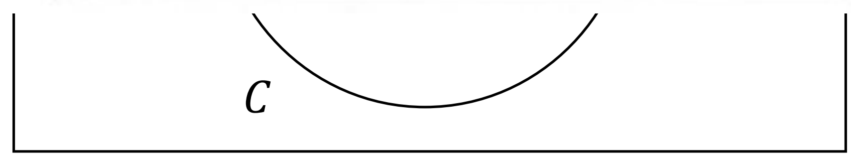




Worked example	Your turn
On the Venn diagram, shade the region representing: $(D \cap F) \cup (E \cap F')$	On the Venn diagram, shade the region representing: $(B \cap C) \cup (A' \cap C)$





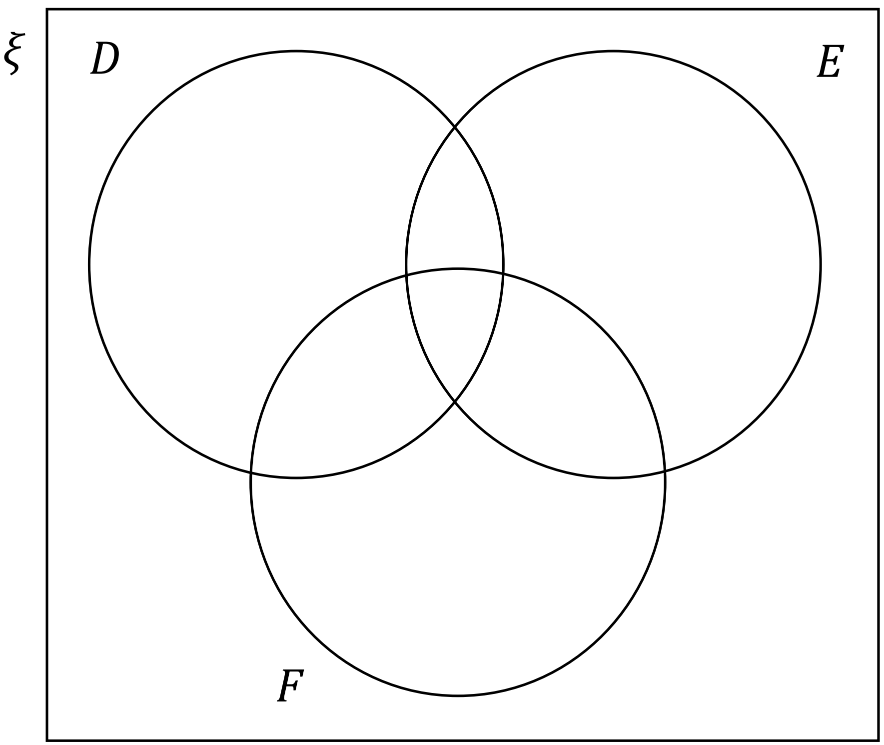


Worked example	Your turn

On the Venn diagram, shade the region representing:

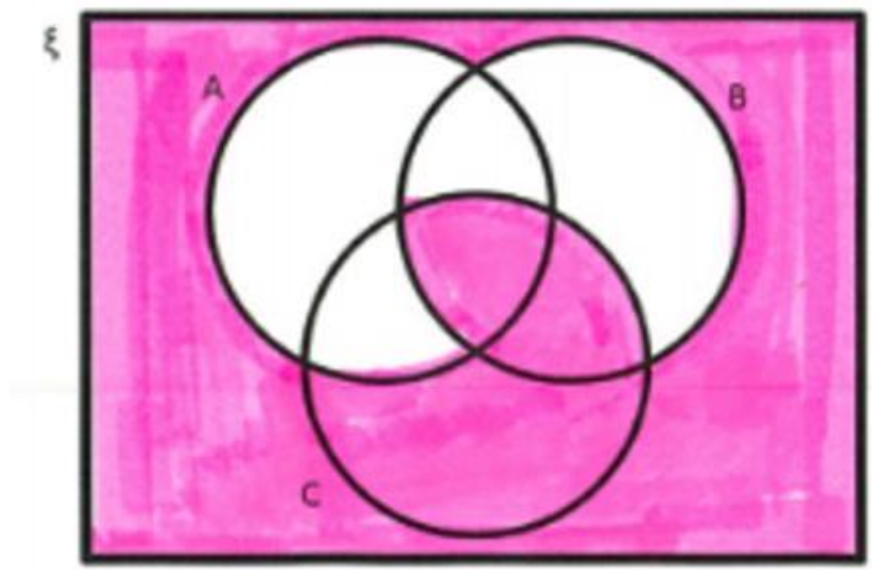
$$(D' \cup F) \cap (D \cup E')$$

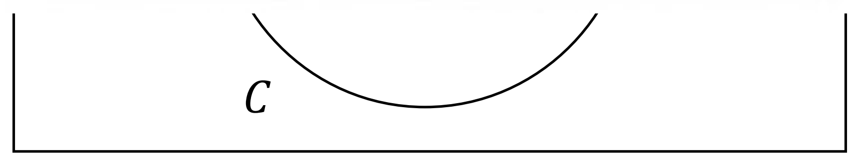
$$(A' \cup B) \cap (B' \cup C)$$

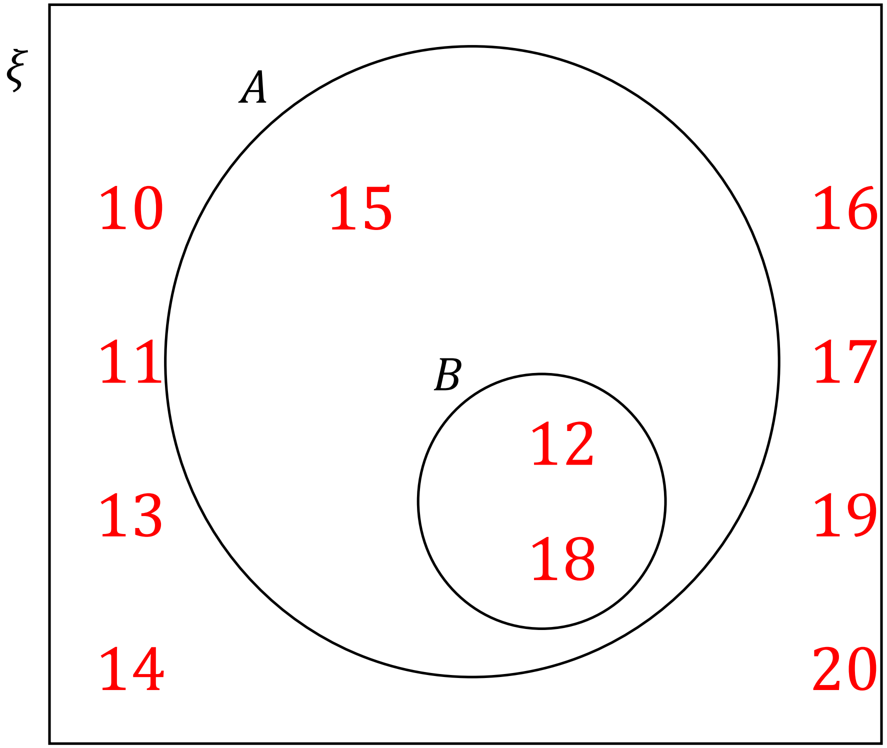


On the Venn diagram, shade the region representing:

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





Worked example	Your turn
Represent as a Venn diagram: ξ =Positive integers between 1 and 10 inclusive A = {Multiples of 2} B = {Multiples of 4}	Represent as a Venn diagram: ξ =Positive integers between 10 and 20 inclusive A = {Multiples of 3} B = {Multiples of 6} 

Worked example	Your turn
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.	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