Basic Set Terminology:

A is the set of students registered for this class. *(Word Description method)*

$B = \{1, 2, 3, 4, 5\}$ *(Roster method)*

$C = \{2, 4, 6, 8\}$ *(Roster method)*

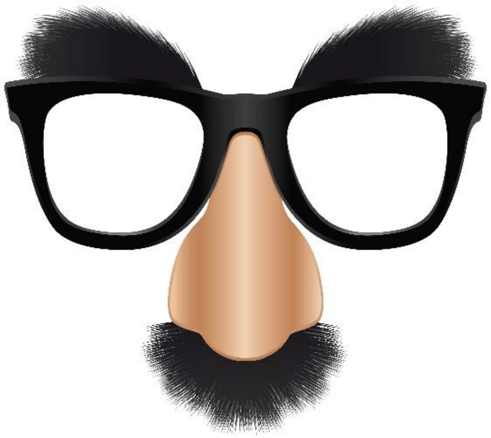
$D = \{x \mid x \text{ is a counting number less than } 6\}$ *(Set-builder notation)*

$E = \{x \mid x \text{ is an even counting number less than } 10\}$ *(Set-builder notation)*

Convert $F = \{1, 2, 3, \ldots, 19\}$ **into set-builder notation.**

There is a special set with no elements called the empty set.

Notation: $\{\ \}$ **or** ϕ**.**



Sometimes the empty set is in disguise.

$$A = \{x \mid x \text{ is greater than 5 and less than 2}\}$$

Set membership:

$\in$ **means is a member or element of**

$\notin$ **means is not a member or element of**

Fill-in the blanks with either $\in$ or $\notin$.

$$3 \,\square\, \{3,5,7\}$$

$$6 \,\square\, \{3,5,7\}$$

$$15 \,\square\, \{1,2,3,\ldots,20\}$$

$$3 \,\square\, \{x \mid x \text{ is a counting number with } 4 \le x \le 9\}$$

$$8 \,\square\, \phi$$

There's a special abbreviation for the Counting Numbers or Natural numbers:

$$\mathbb{N} = \{1,2,3,4,5,6,\ldots\}$$

<u>Cardinal Number and Cardinality:</u>

The cardinal number or cardinality of a set, *A*, is the number of elements in the set *A*.

Notation: $n(A)$

Determine the following cardinal numbers:

$$n(\{2,4,6,8\}) =$$

$$n(\{x \mid x \in \mathbb{N} \text{ with } 4 \le x \le 12\}) =$$

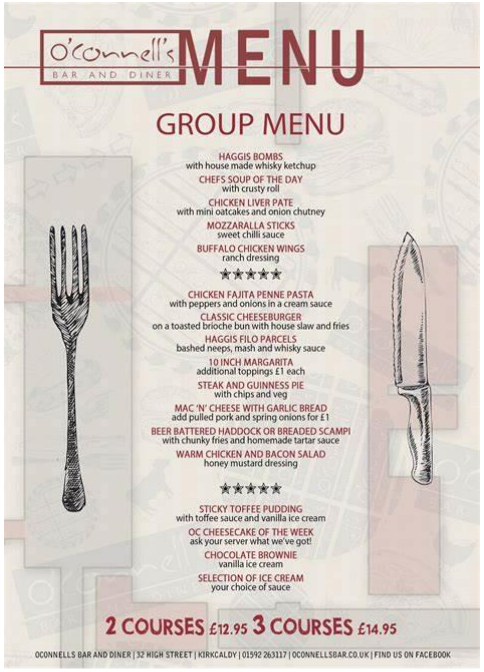
$$n(\{x \mid x \in \mathbb{N} \text{ with } x \le 4 \text{ and } x > 7\}) =$$

$$n(\{2,2,4,6,8\}) =$$

Subsets:

A set *A* is a subset of the set *B* if each element of *A* is also an element of *B*.

Notation: $A \subset B$ ***{****Think of B as a menu and a subset A as an order from the menu.}*



Fill-in the blanks with either $\subset$ or $\not\subset$.

$$\{3,7\} \; \square \; \{3,5,7\}$$

$$\{3,6\} \; \square \; \{3,5,7\}$$

$$\{4,5,6,\ldots,13\} \; \square \; \{1,2,3,\ldots,20\}$$

$$\{1,2,3,4,5\} \; \square \; \phi$$

$$\phi \; \square \; \{a,b,c\}$$

$$\{1,2,3\} \; \square \; \{1,2,3\}$$

$$\phi \; \square \; \phi$$

How many subsets does a set have?

Set *A*	$n(A)$	**Subsets of *A***	**# of subsets**
ϕ	**0**	ϕ	**1**
$\{a\}$	**1**	$\phi, \{a\}$	**2**
$\{a,b\}$	**2**	$\phi, \{a\},$ $\{b\}, \{a,b\}$	
$\{a,b,c\}$	**3**	$\phi, \{a\}, \{b\}, \{c\}, \{a,b\},$ $\{a,c\}, \{b,c\}, \{a,b,c\}$	

Use inductive reasoning to complete the following:

If a set has *n* elements, then it has _______________ subsets.

How many subsets are there of the set $\{a, b, c, d, e\}$?

A pizza can be ordered with some, none, or all of the following toppings:

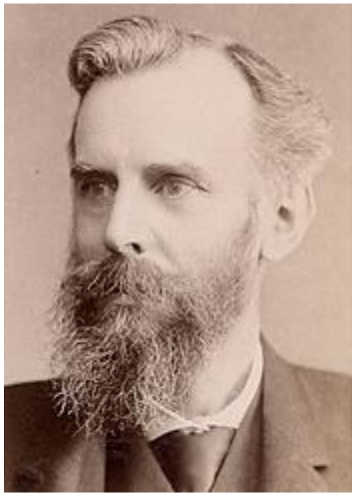
$\{pepperoni, sausage, mushroom, onion, peppers, black\ olives, green\ olives, hamburger\}$**.**

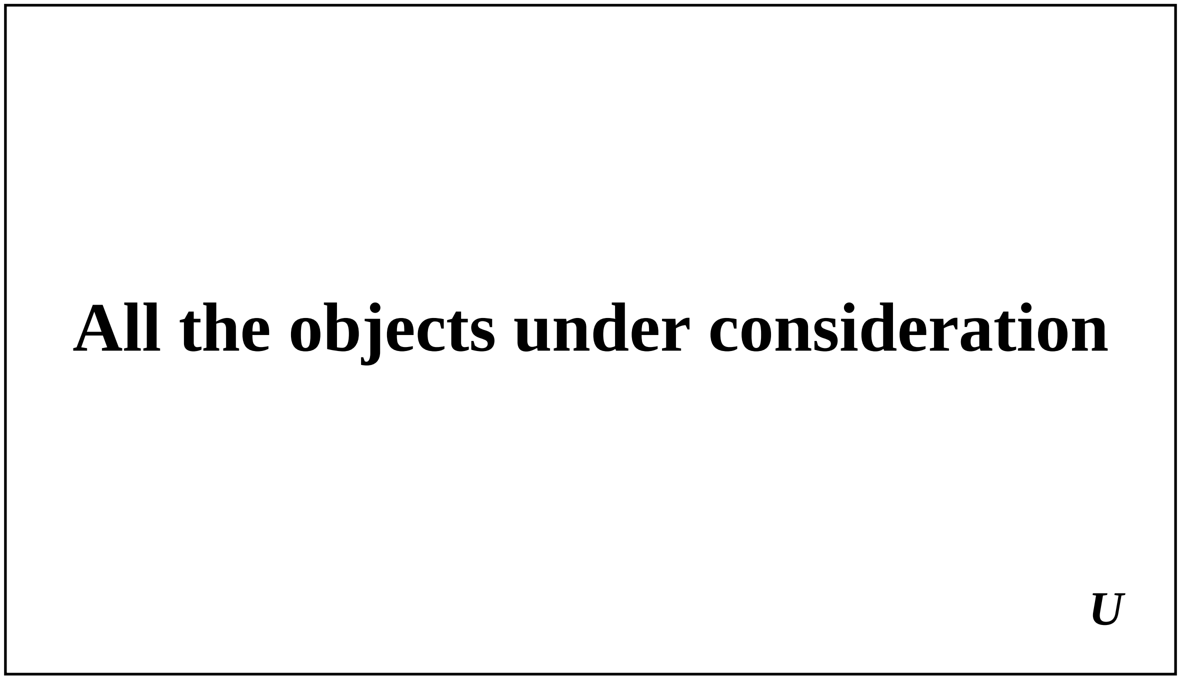
How many different pizzas are possible?

In this example, what would correspond to the empty set?

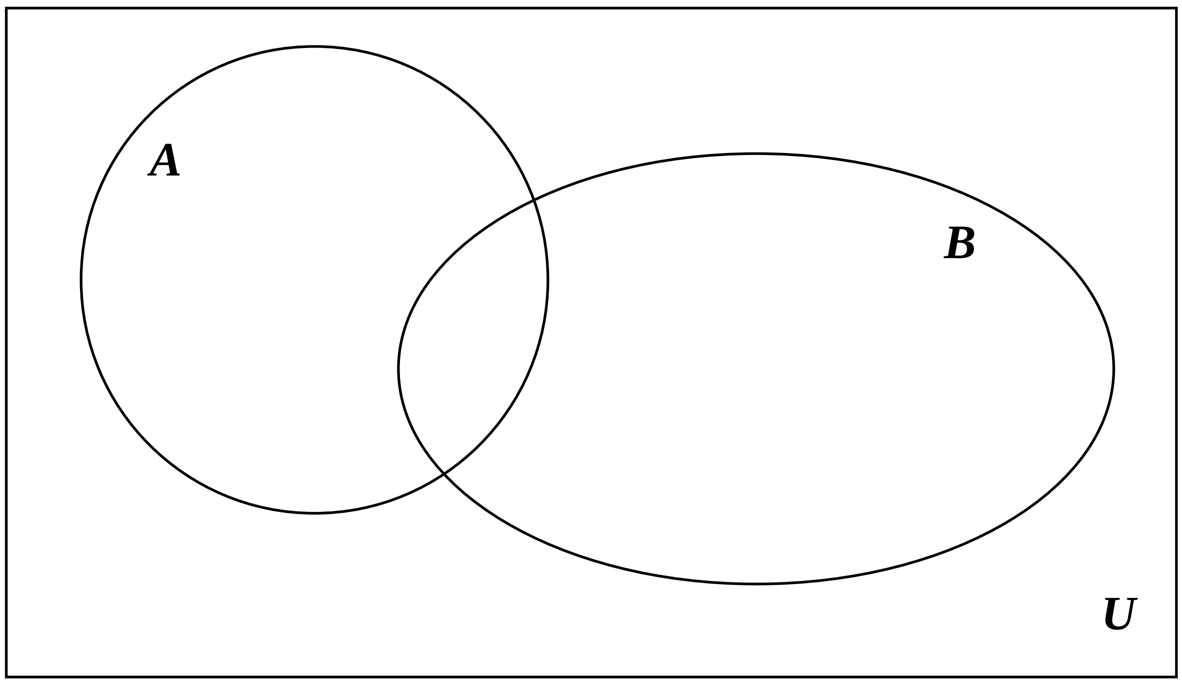
Set Operations and Venn Diagrams:

In a particular problem or situation, the set of all objects under consideration is called a universal set. It is abbreviated with the letter *U*, and represented in a Venn diagram as a large square or rectangle.





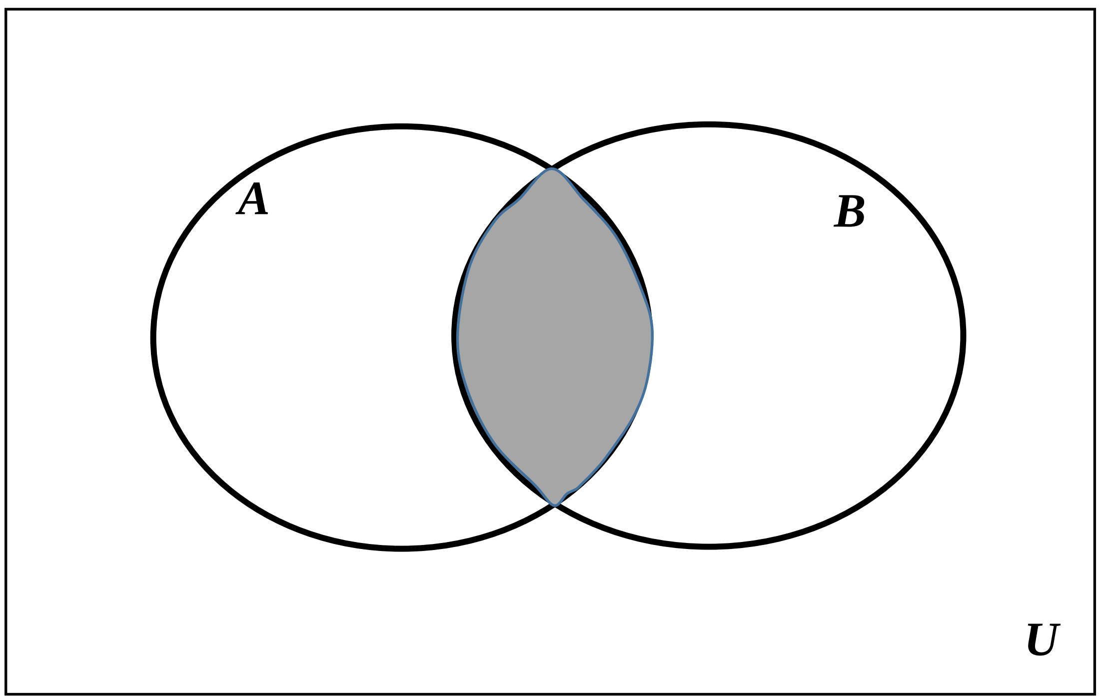
Sets of objects in a universal set are represented by circles or ovals.



Set Intersection:

The intersection of sets *A* and *B*, written as $A \cap B$, is the set of elements common to both set *A* *and* set *B*. In other words, it's the objects shared by the two sets.

$A \cap B$ is represented in a Venn diagram as the shaded region, the region of overlap of the two ovals.



Examples: $A = \{1, 2, 3, 4, 5, 6\}$ $B = \{2, 3, 4, 5, 7\}$ $C = \{5, 8\}$ $D = \{1, 2, 3\}$

List the elements in the following sets:

$A \cap B$

$B \cap C$

$A \cap C$

$C \cap D$

$A \cap \phi$

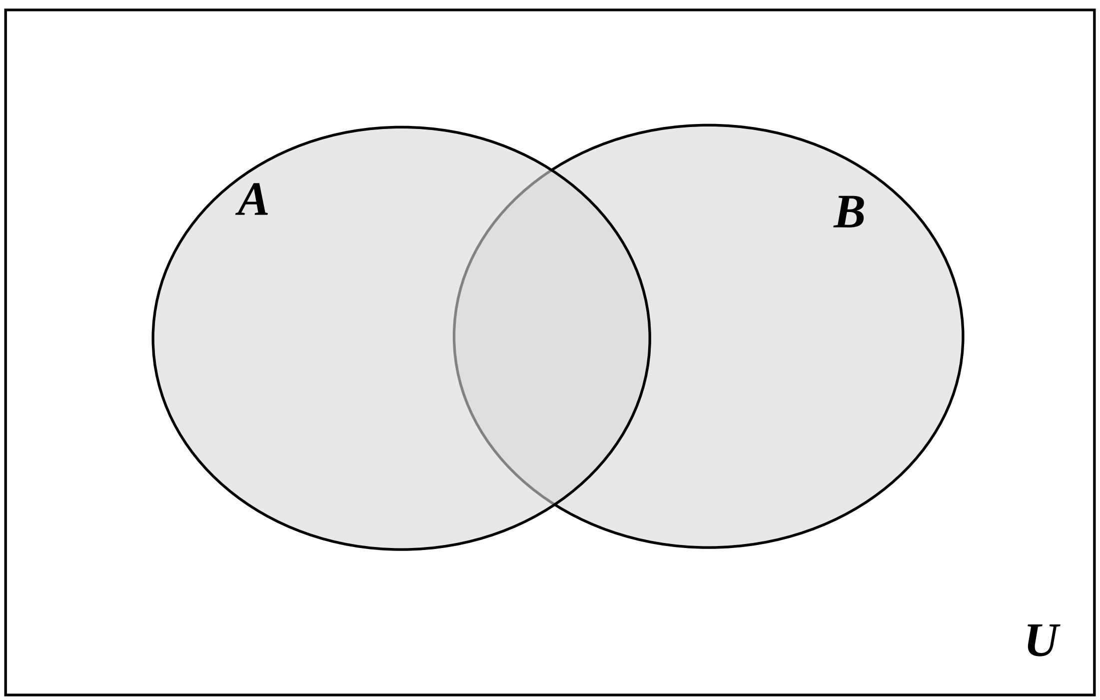
$A \cap B \cap C$

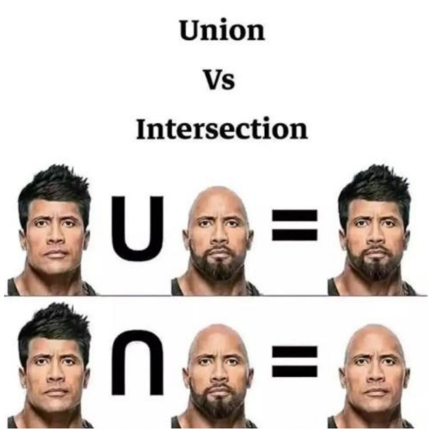
$C \cap C$

Set Union:

The union of sets *A* and *B*, written as $A \cup B$, is the set of elements that are in set *A* *or* in set *B*, *or* in both. In other words, it's the elements of both sets combined into one.

$A \cup B$ is represented in a Venn diagram as the shaded region below. It's formed by joining the regions inside the ovals.





Examples: $A = \{1, 2, 3, 4, 5, 6\}$ $B = \{2, 3, 4, 5, 7\}$ $C = \{5, 8\}$ $D = \{1, 2, 3\}$

List the elements in the following sets:

$A \cup B$

$C \cup D$

$\phi \cup D$

$A \cap (C \cup D)$

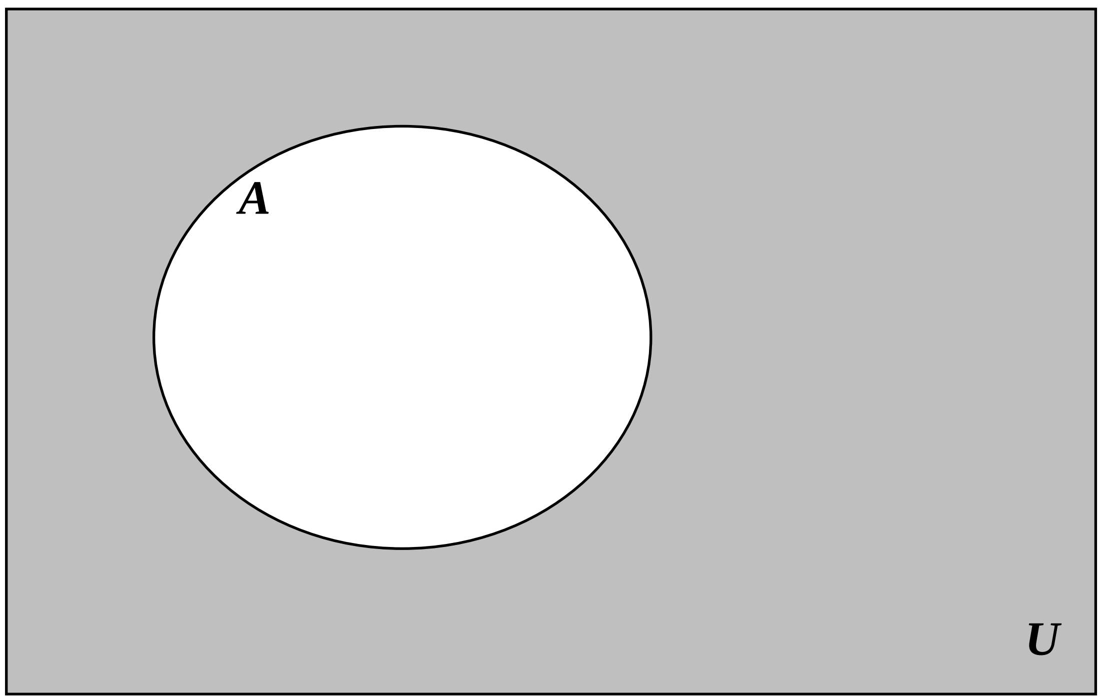
$A \cup B \cup C$

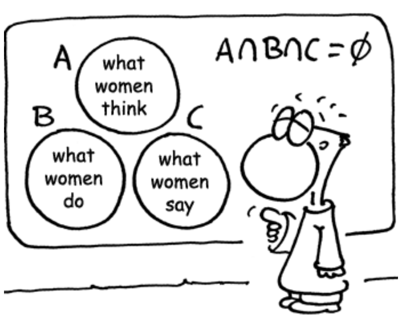
$(B \cap C) \cup (A \cap D)$

<u>Set Complement:</u>

The complement of the set *A*, written A', is the set of all objects in the universe that are *<u>not</u>* in the set *A*. In other words it's the opposite of *A*.

A' is represented in a Venn diagram as the shaded region below. It's the region outside of the oval.





"Well, let's continue with set theory, today we will see the concept of disjoint sets."

Examples: $A=\{1,2,3,4,5,6\}$ $B=\{2,3,4,5,7\}$ $C=\{5,8\}$ $D=\{1,2,3\}$

$U=\{1,2,3,4,5,6,7,8\}$

List the elements in the following sets:

A'

B'

$(A\cap B)'$

$(A\cup B)'$

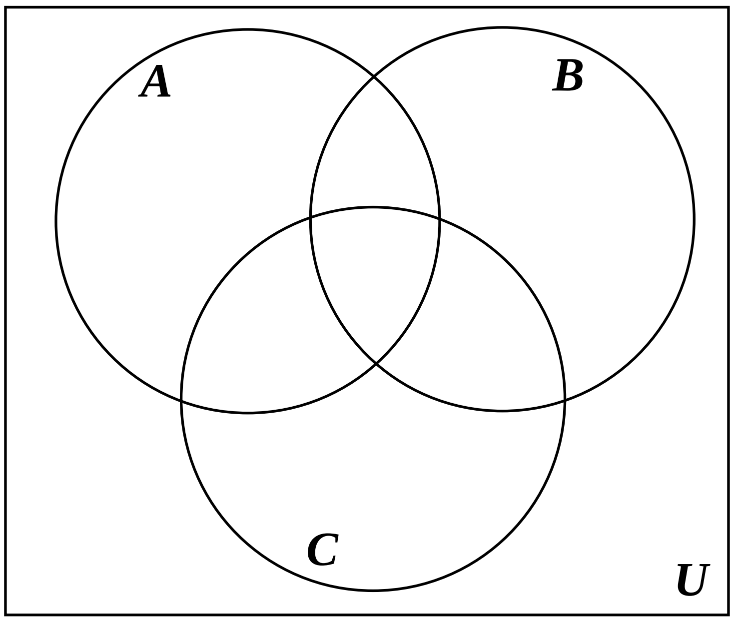
$B'\cap C$

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

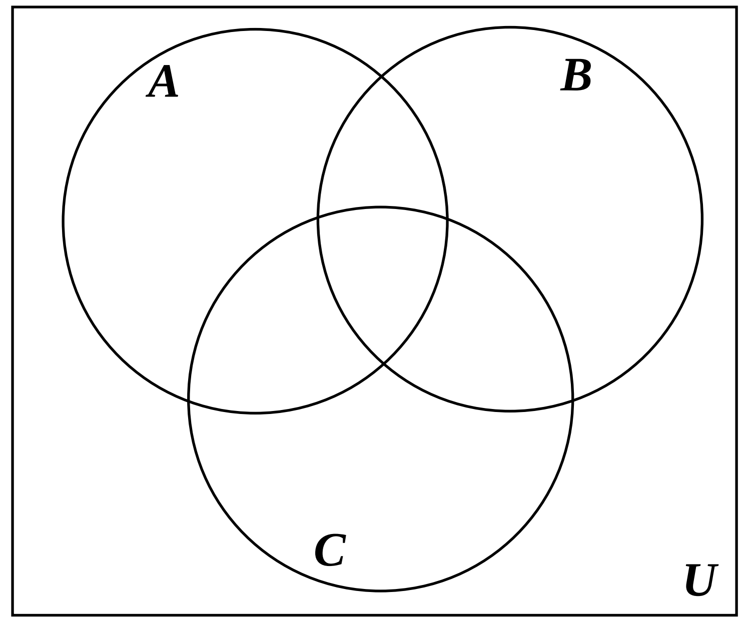
$A'\cap B'$

$A'\cup B'$

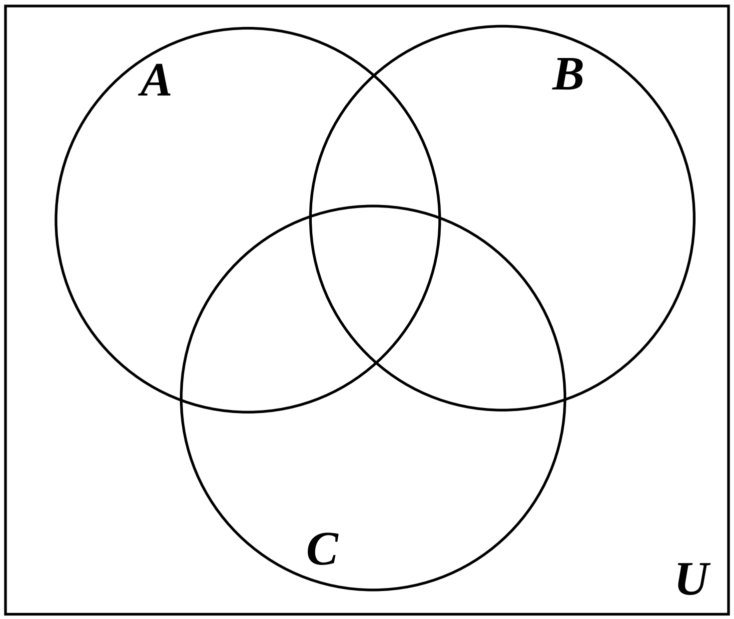
Shade the region(s) that is represented by the following set operations.



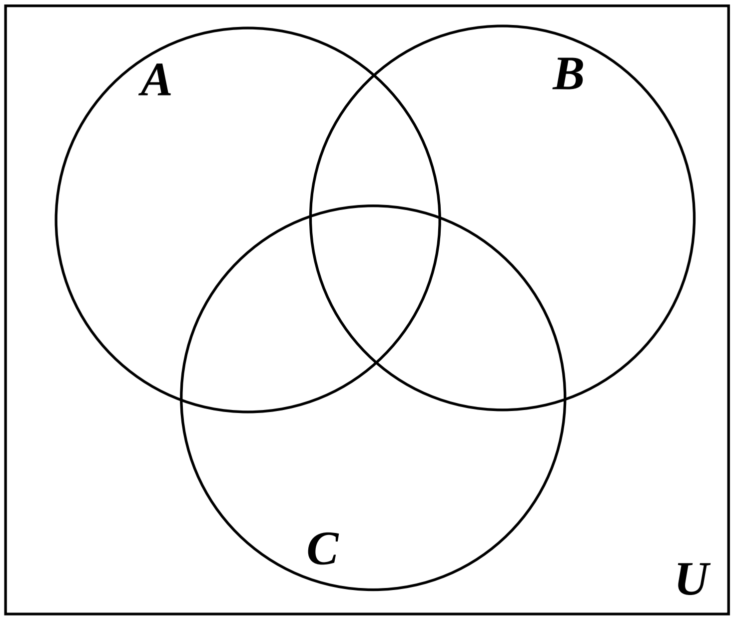
$A \cap B \cap C$



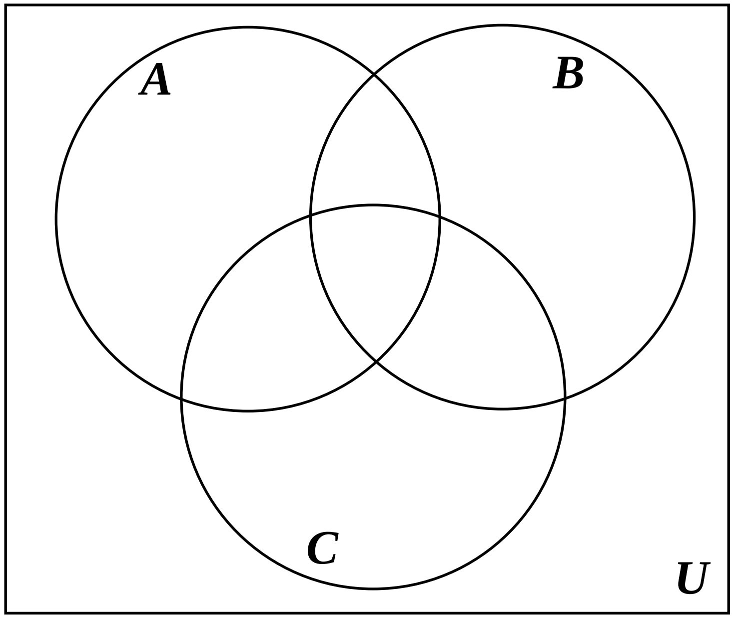
$A \cup B$



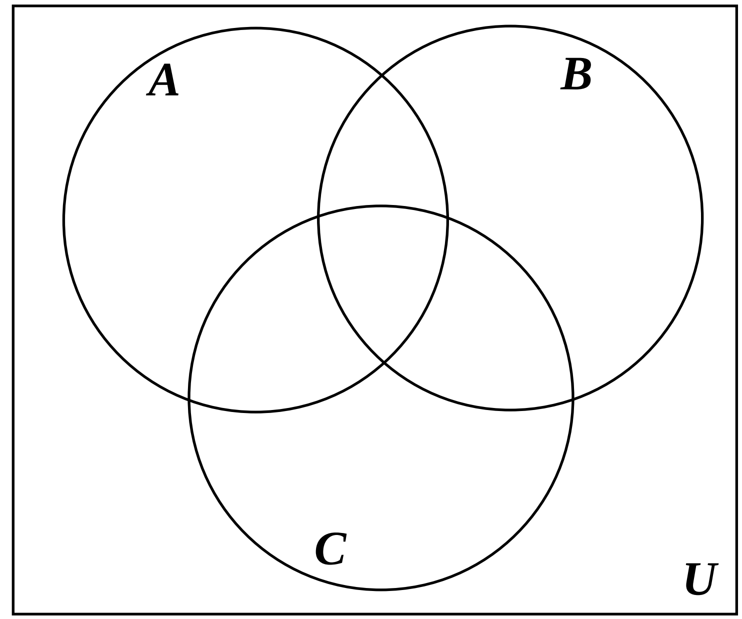
$A \bigcap B'$



$C \bigcap B$



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

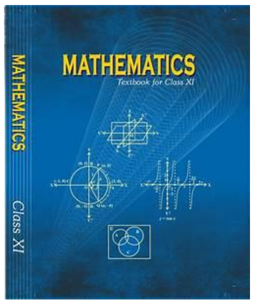


$C \cap (A \cup B)'$

Analyzing Surveys Using Venn Diagrams:

Examples:

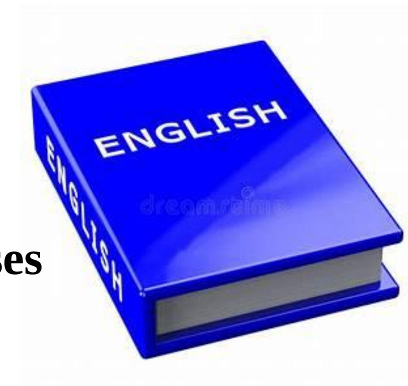
1. A survey of 100 students regarding their semester courses resulted in the following:



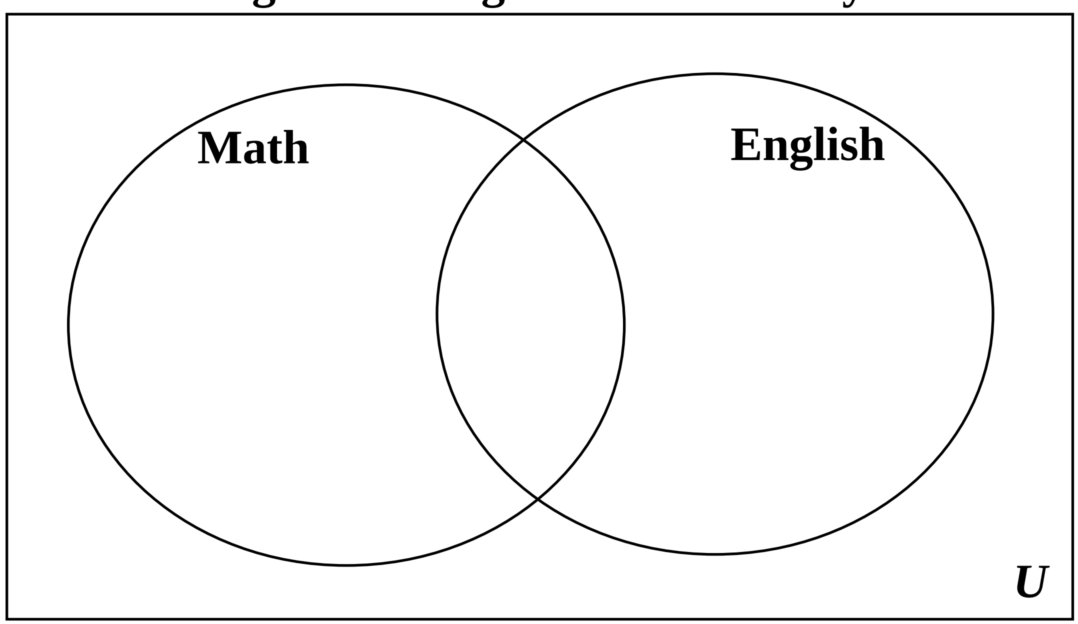
48 students are taking a Math class

53 students are taking an English class

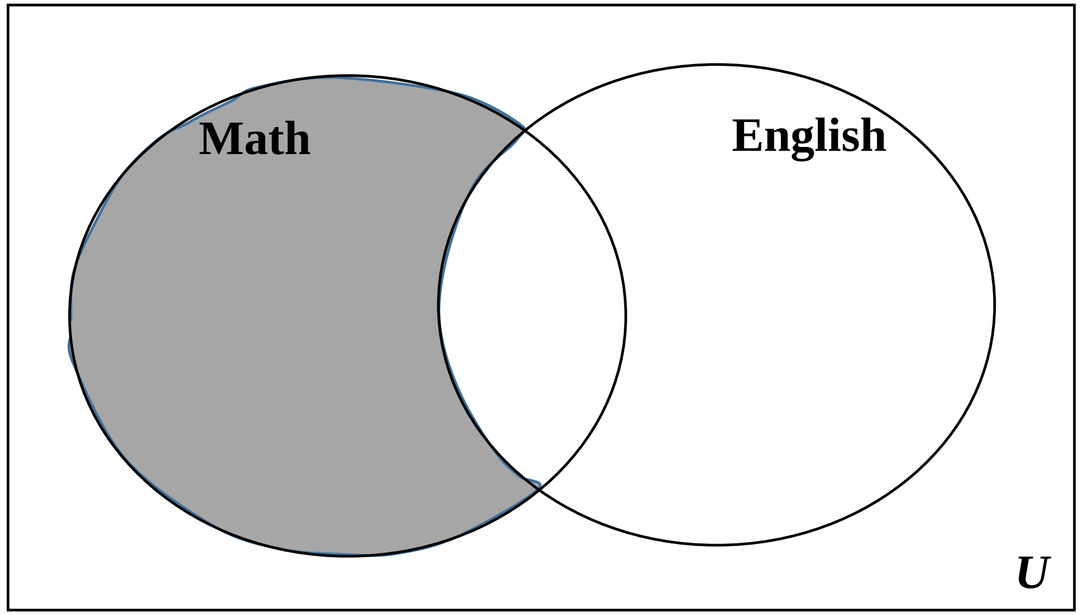
31 students are taking both Math and English classes



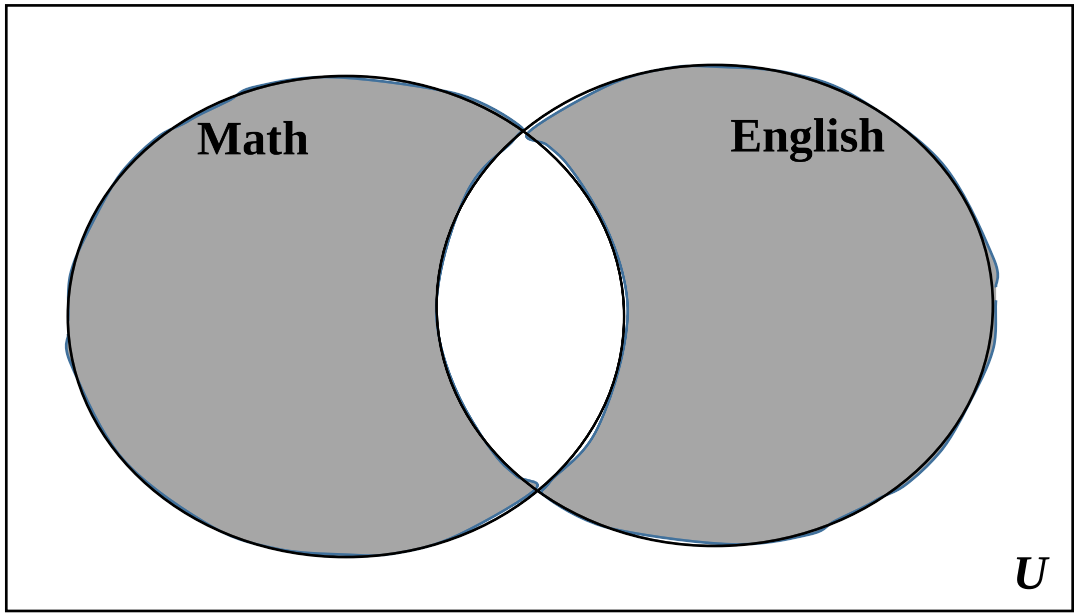
a) Complete the following Venn Diagram of the survey.

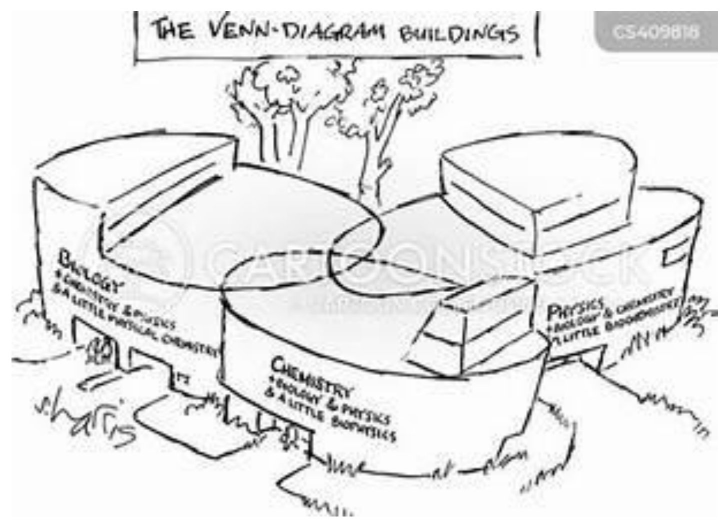


b) How many of the students are taking only a Math class?

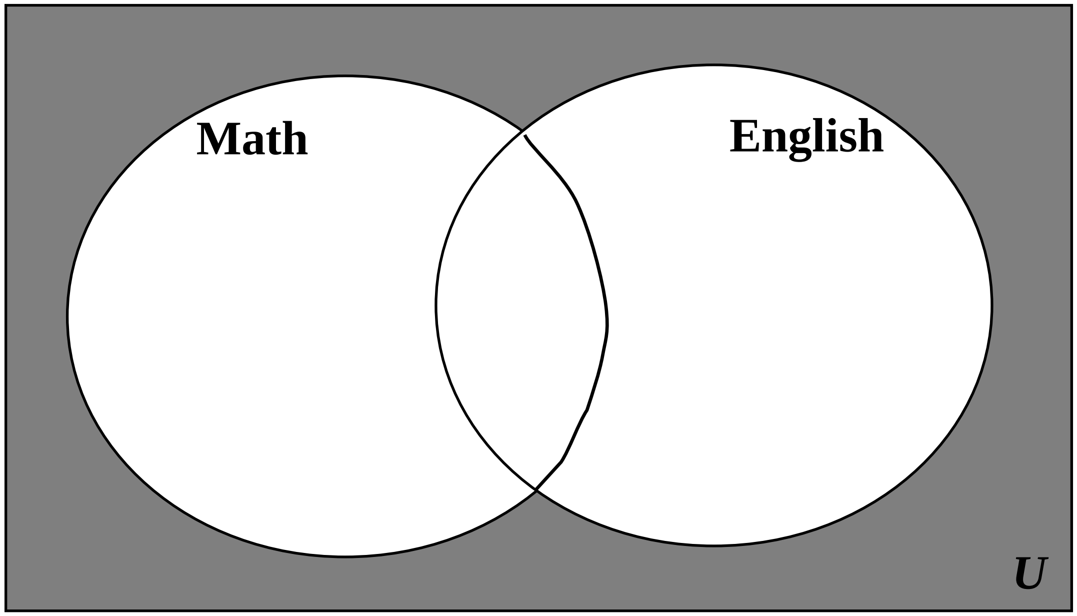


c) How many of the students are taking only one of the two classes?





d) How many of the students aren't taking a Math or English class?



2. A survey of 180 students resulted in the following:

43 students were in a campus club

52 played in a campus sport

35 were in a campus tutorial program

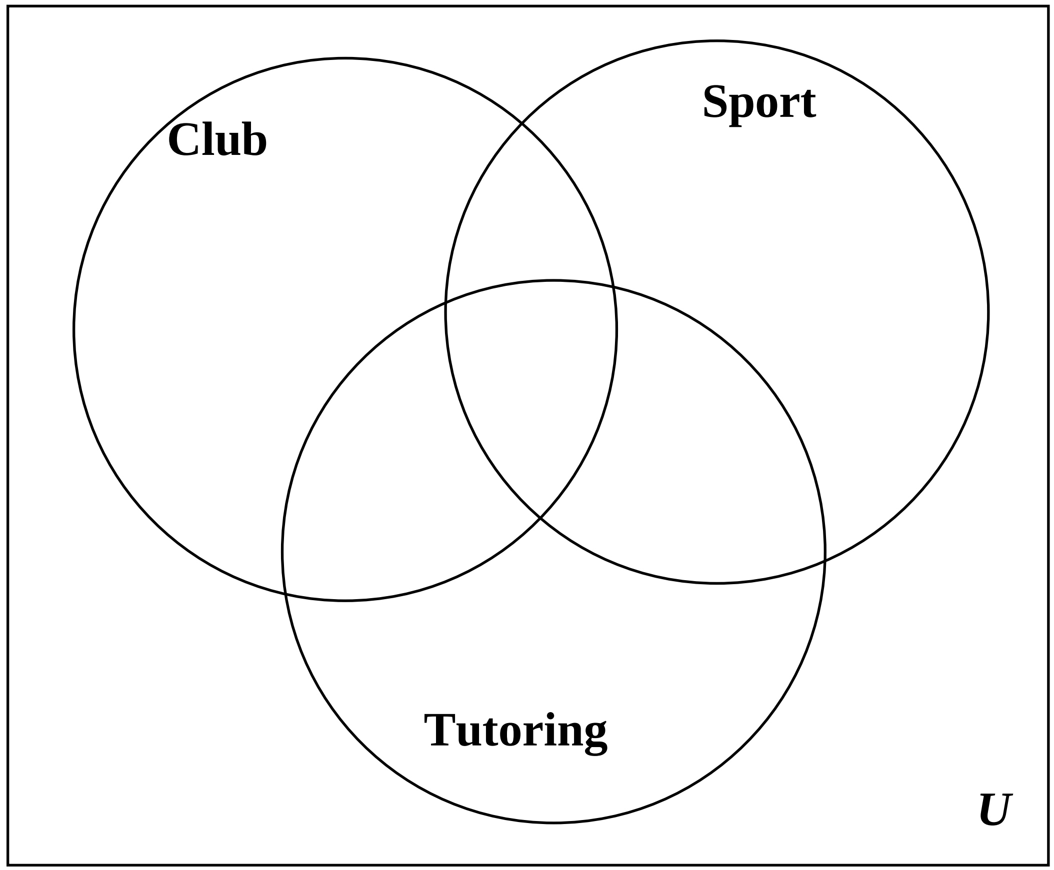
13 were in a club and a sport

14 were in a sport and a tutorial program

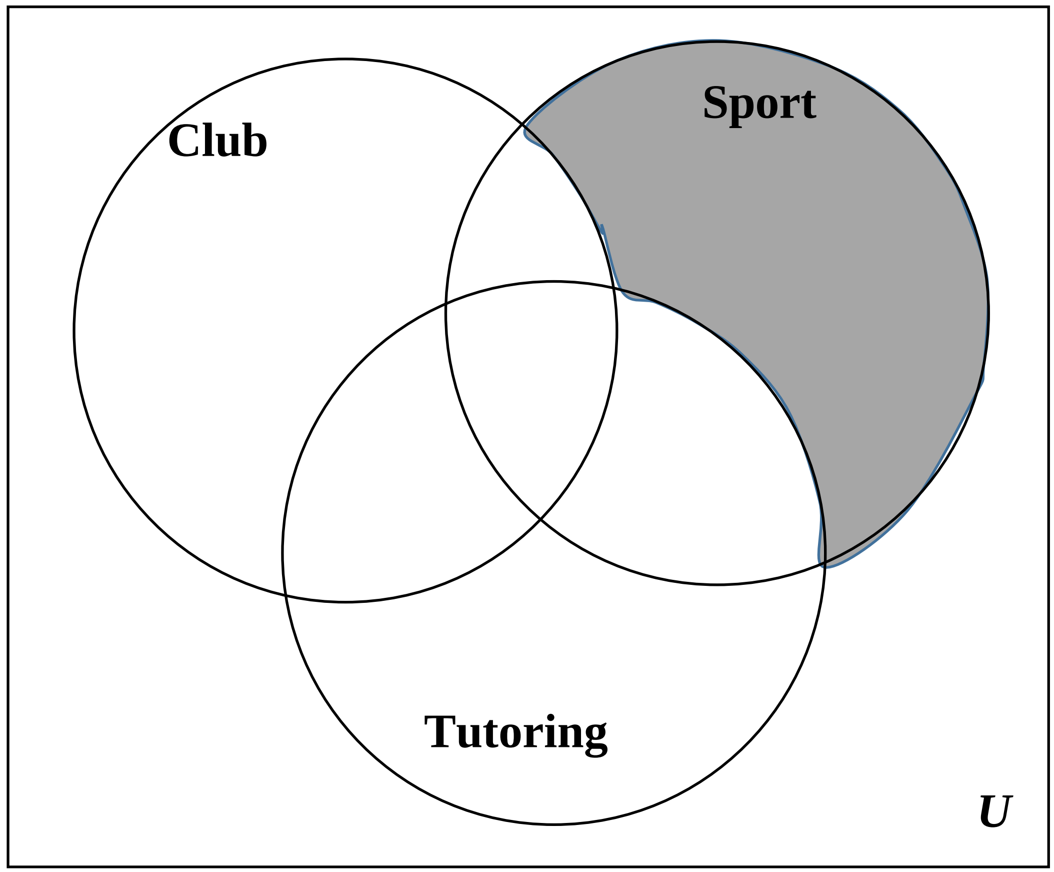
12 were in a club and a tutorial program

5 were in all three activities

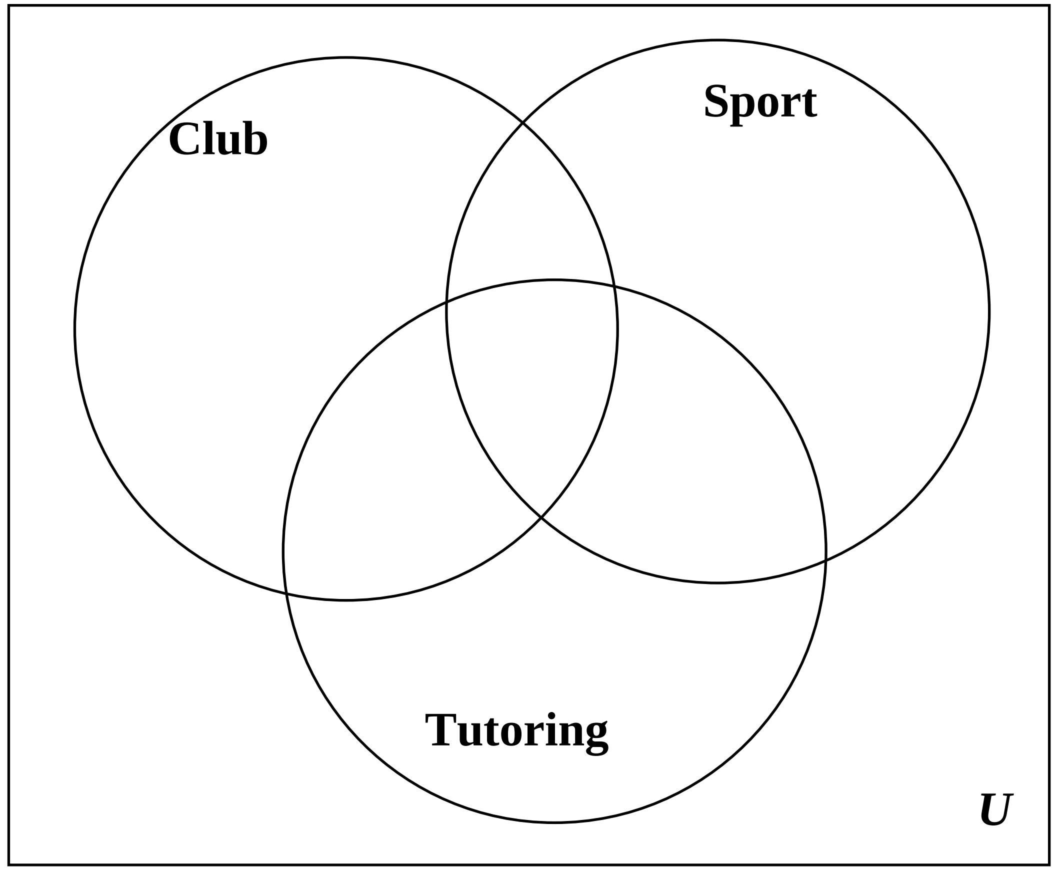
a) Complete the following Venn Diagram of the survey.



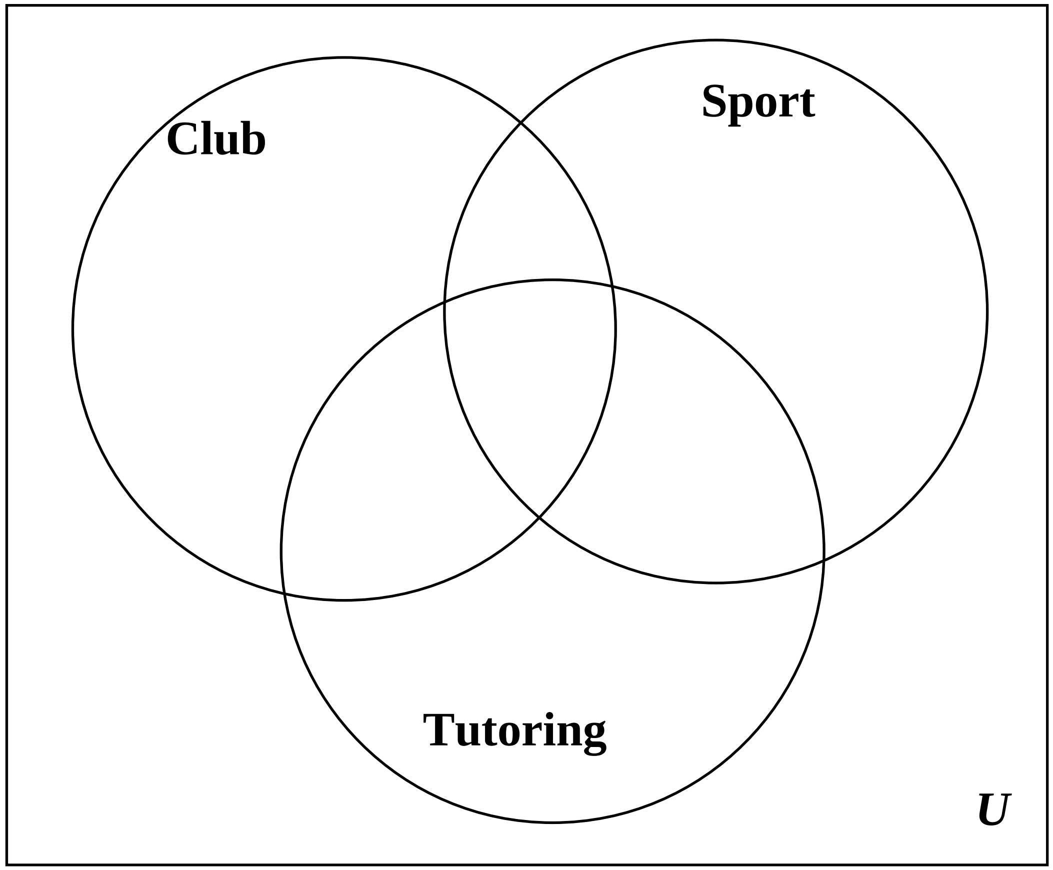
b) How many participated only in a sport?



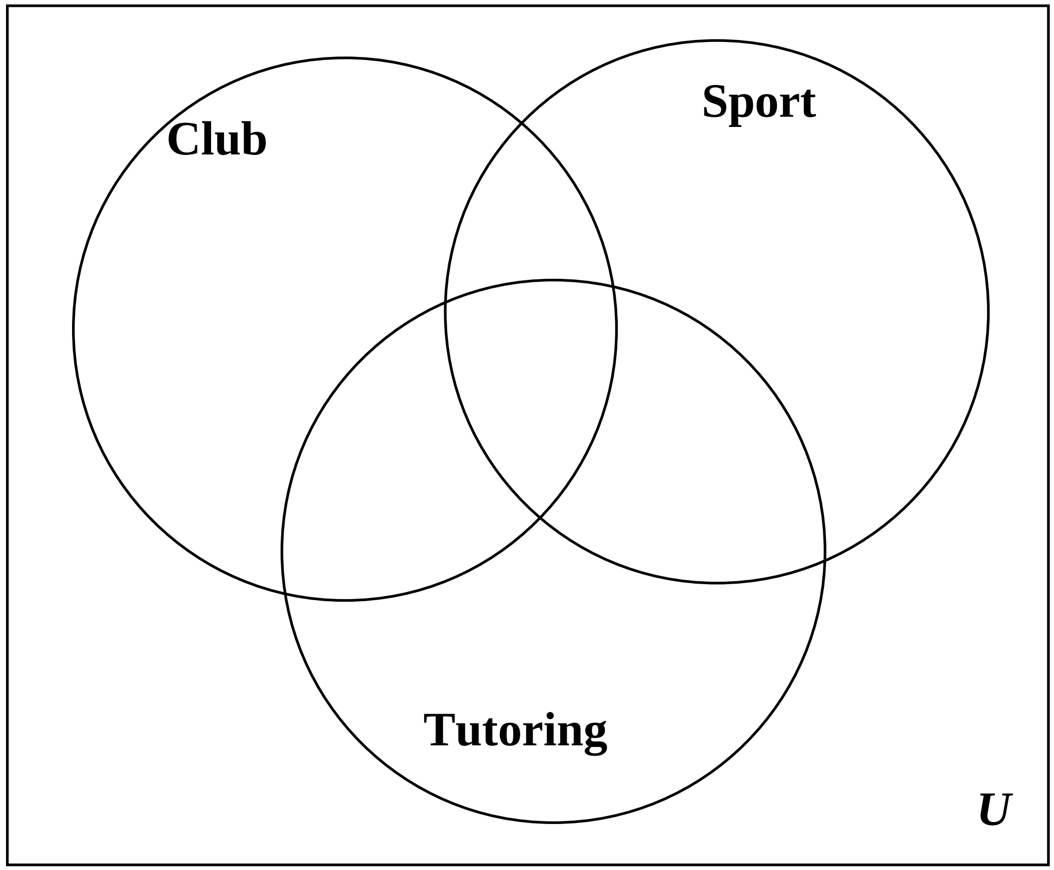
c) How many participated in a club and a sport, but not a tutoring program?



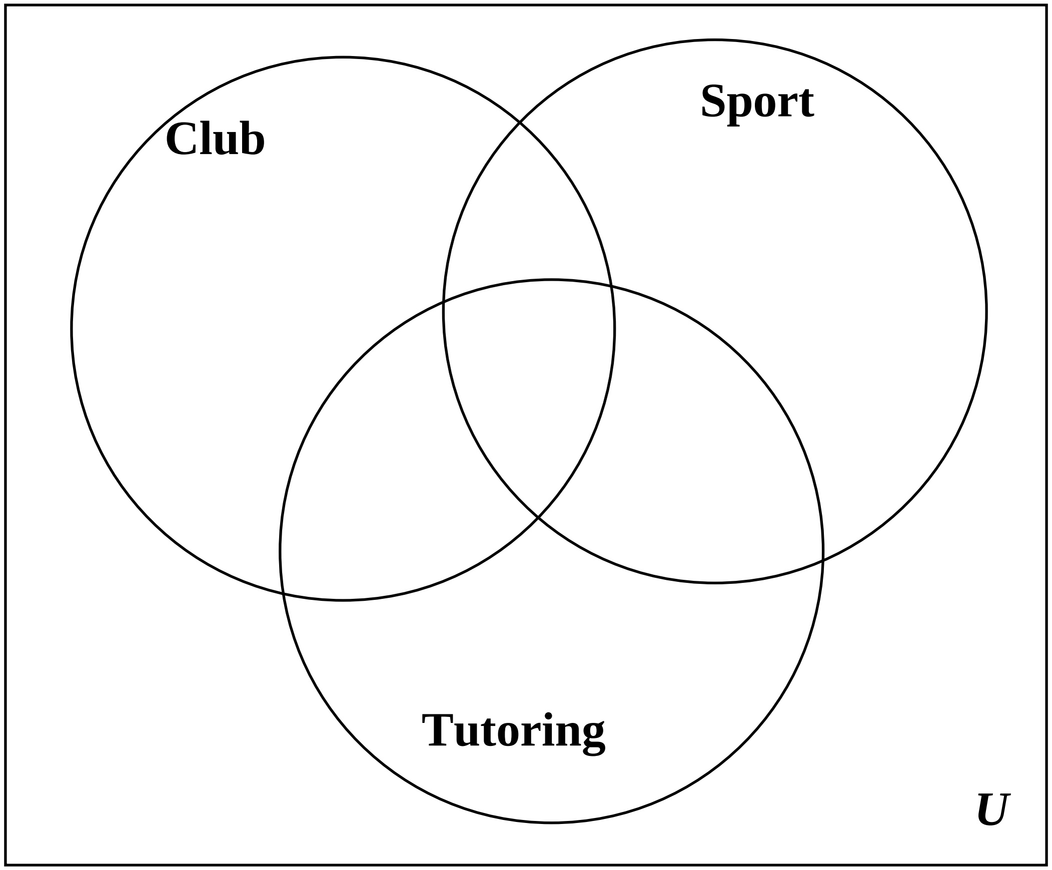
d) How many participated in a club or a sport, but not a tutoring program?



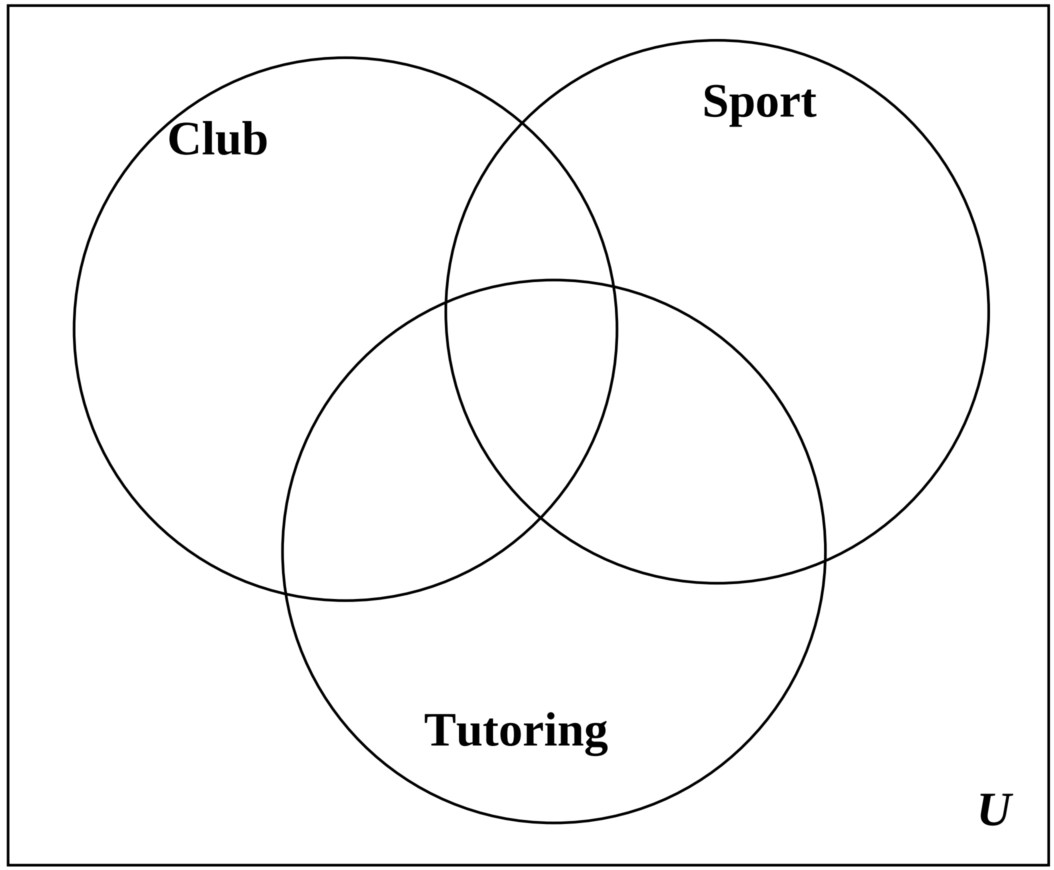
e) How many participated in exactly one of the three activities?



f) How many participated in at least two of the activities?

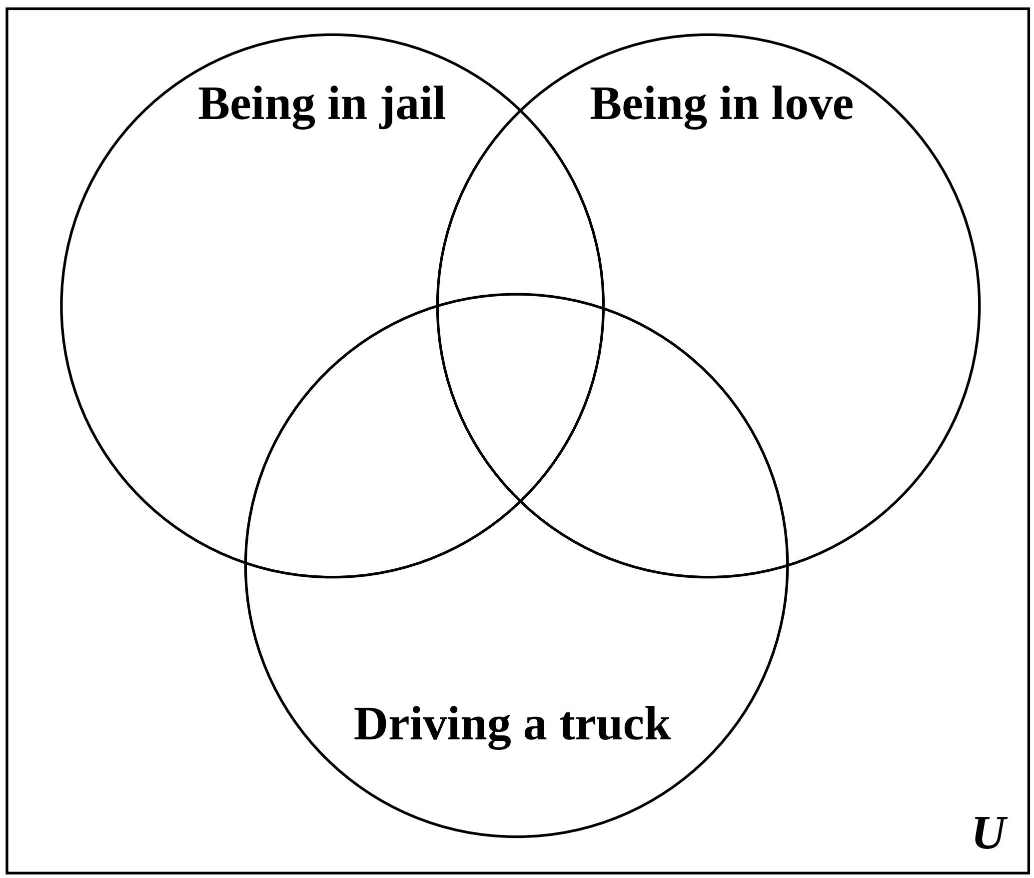


g) How many didn't participate in any of the three activities?

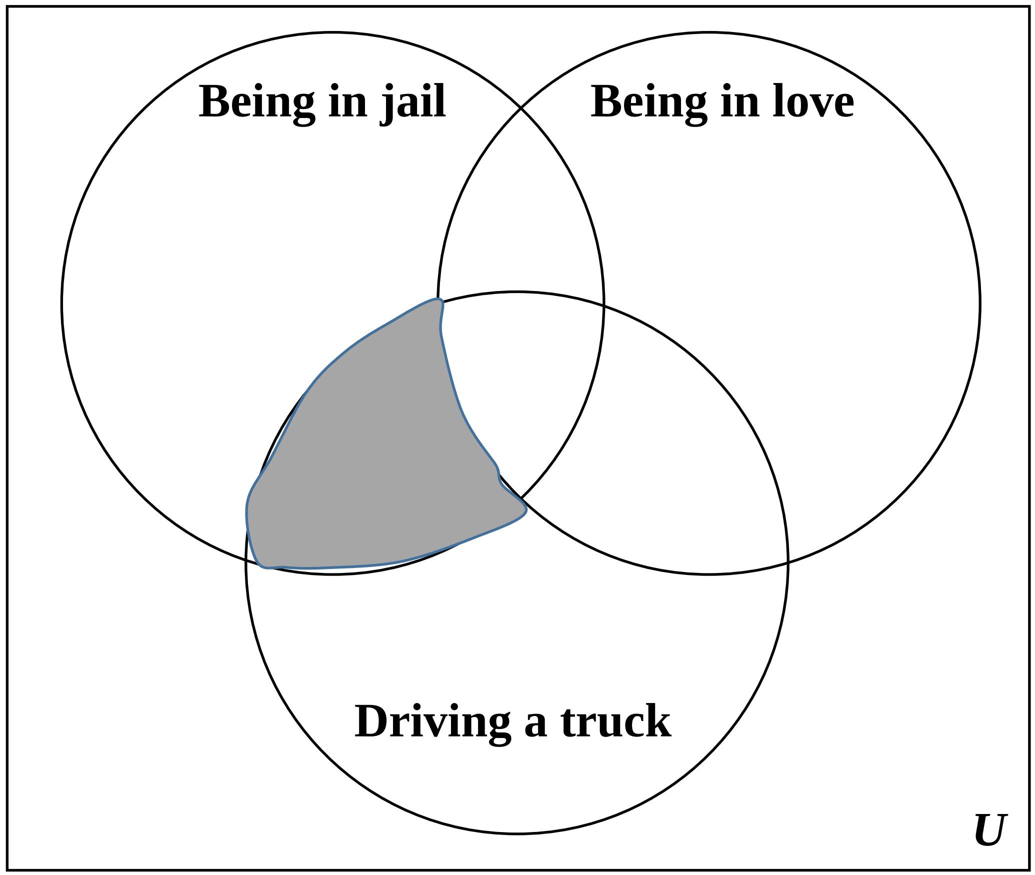


3. **A survey of 80 country music songs resulted in the following: 36 songs are about being in jail, 44 songs are about being in love, 26 songs are about driving a truck, 18 songs are about being in jail and being in love, 14 songs are about being in jail and driving a truck, 11 songs are about being in love and driving a truck, and 4 songs are about being in jail and being in love and driving a truck.**

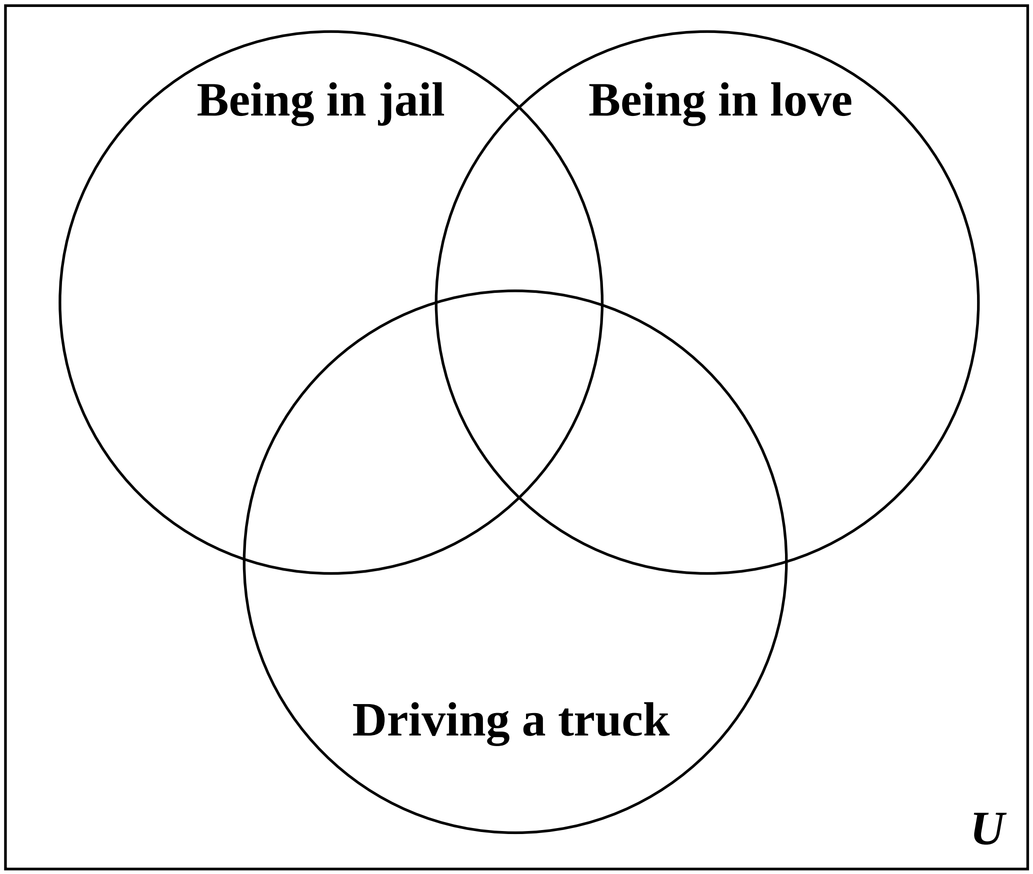
a) Complete the following Venn Diagram.



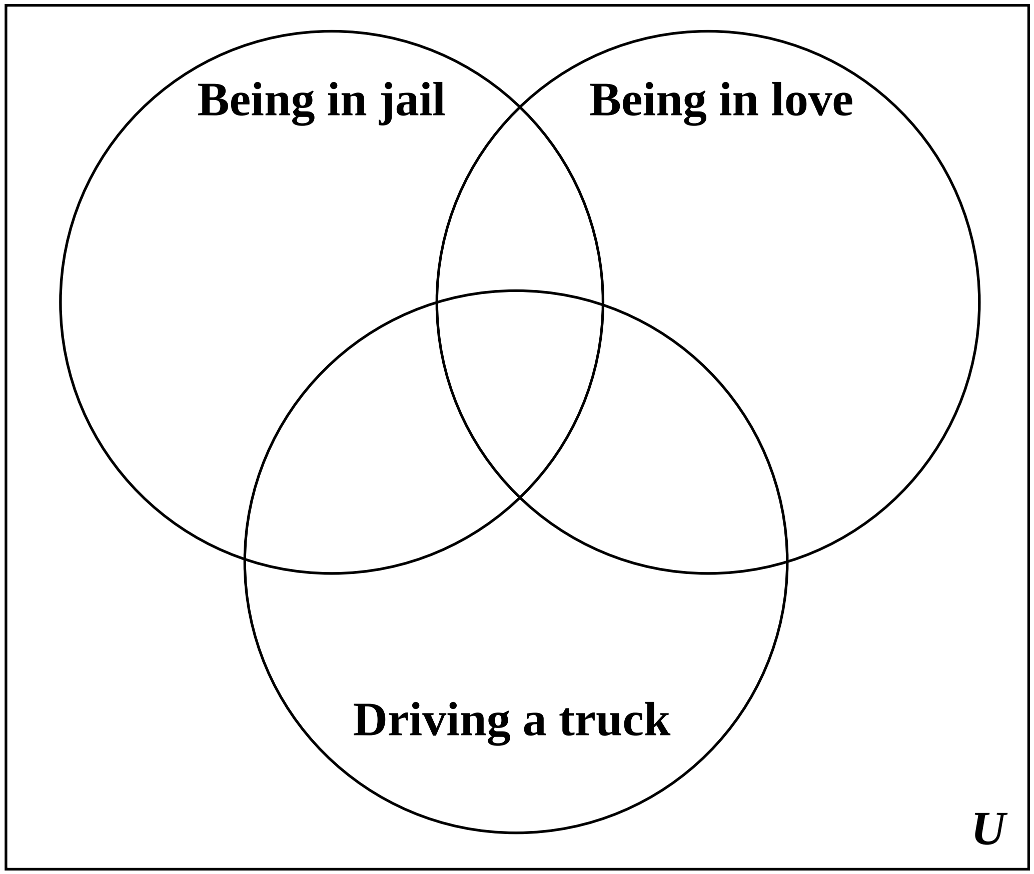
b) How many songs are about being in jail and driving a truck, but not being in love?



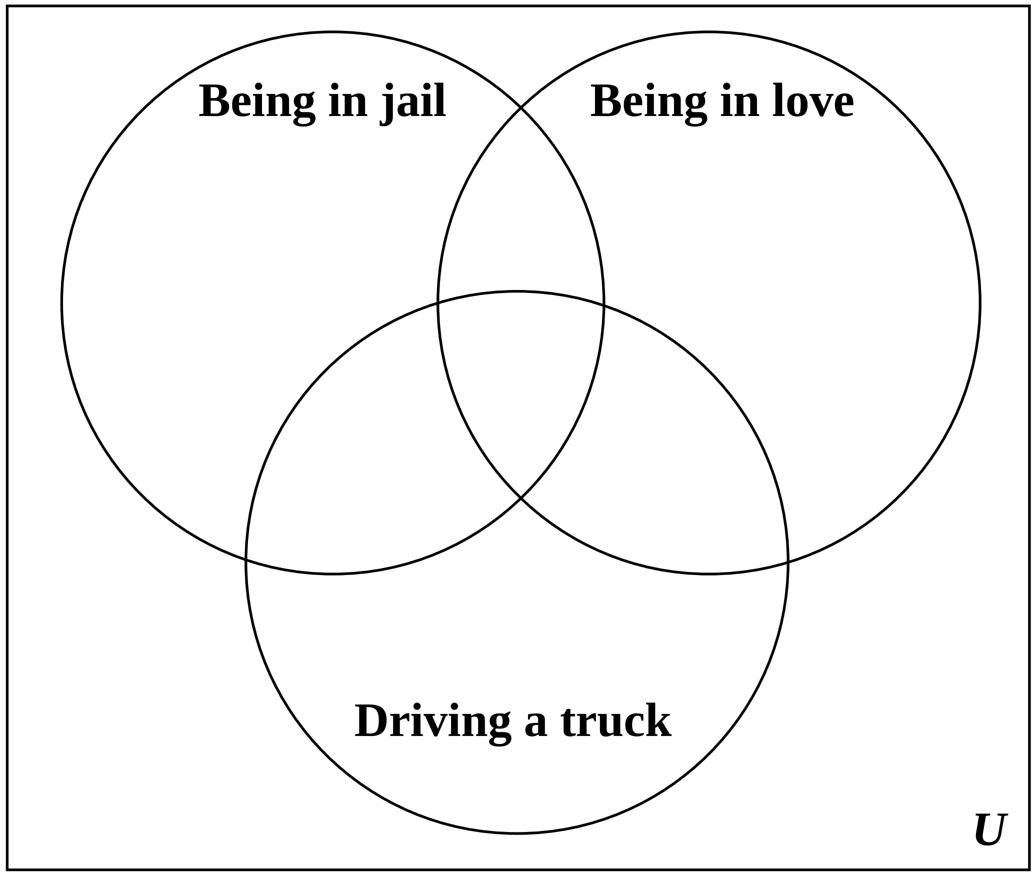
c) How many songs are only about driving a truck?



d) How many songs are not about being in jail or being in love, or driving a truck?



e) How many songs are not about driving a truck?



f) How many songs are about exactly two of the topics?