MATH 3307
Lesson 7

Sets and Venn Diagrams

A set is a collection of objects. Two sets are equal if they contain the same elements.

$A = \{1, 2, 3, 4\}$ $B = \{1, 2, 3, 4, 5\}$

Set A is a **subset** of set B if every element that is in set A is also in set B. The notation for this is $A \subseteq B$.

$A \subseteq B$

Set A is a **proper subset** of set B if every element that is in set A is also in set B *and* there is at least one element in set B that is not in set A. The notation for this is $A \subset B$.

(A and B are Not Equal)

Sets and Subsets

If Set A contains all dogs, and Set B contains all Golden Retrievers, then $B \subseteq A$.

When using subset notation, you cannot reverse the order (except if the sets are equal)

However, $A \subseteq B$ is not true.

An Example of Sets

To belong to Set A, you must be over the age of 25.

To belong to Set B, you must drive a blue car.

Think about which sets you would belong to.

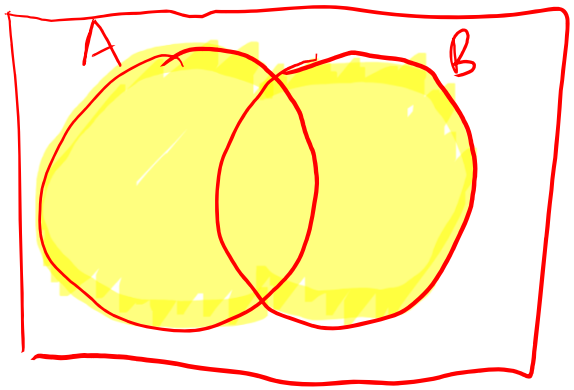
Set Union

"or"

$A \cup B$

The **union** of A and B, which is written as $A \cup B$, is the set of all elements that belong either to set A or to set B (or that belong to both A and B).

If you answered "yes" to either of the questions, you belong in the set union.



Set Intersection

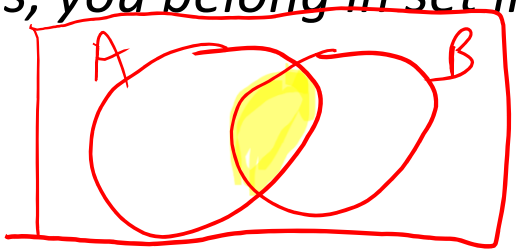
Must be in the overlap of sets A and B

"And"

The **intersection** of A and B, which is written as $A \cap B$, is the set of all elements that belong to both to set A and set B. If the intersection of two sets is empty (the empty set is denoted by $\varnothing$, then the sets are **disjoint** or **mutually exclusive** and we write $A \cap B = \phi$

{ } $\varnothing$ Disjoint or Mutually Exclusive (Nothing in Common)

If you answered, "yes" to both questions, you belong in set intersection.

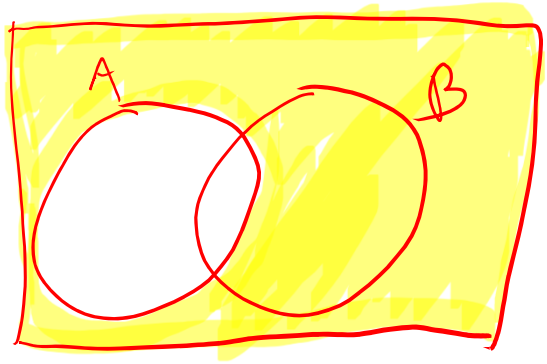


Set Compliment

"Not"

The **complement of set** A, which is written as A^c, is the set of all elements that are in the universal set but are not in set A.

If you answered "no" to question A, you belong in the set compliment.



Examples:

Use the following information to answer the questions:

universe

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

$A = \{1, 2, 5, 6, 9, 10\}$

$B = \{3, 4, 7, 8\}$

$C = \{2, 3, 8, 9, 10\}$

$B \cup C = \{2, 3, 4, 7, 8, 9, 10\}$ (B or C)

Find:

$A^c = \{3, 4, 7, 8\}$ (Not in A)

$A \cup C = \{1, 2, 3, 5, 6, 8, 9, 10\}$ (A & C)

$A \cap B = \{\}$ or $\emptyset$ (A and B)

$A^c \cap C = \{3, 8\}$ (Not in A and in C)

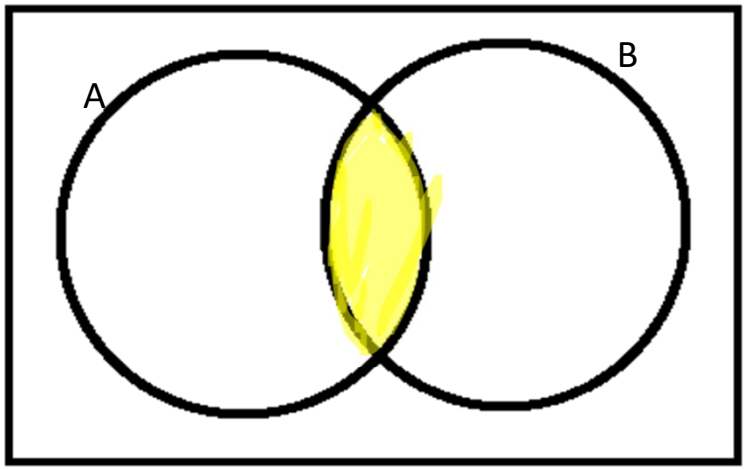
$(B \cup C)^c = \{1, 5, 6\}$ (Not in B or C)

$A \cap B \cap C = \{\}$ (All three)

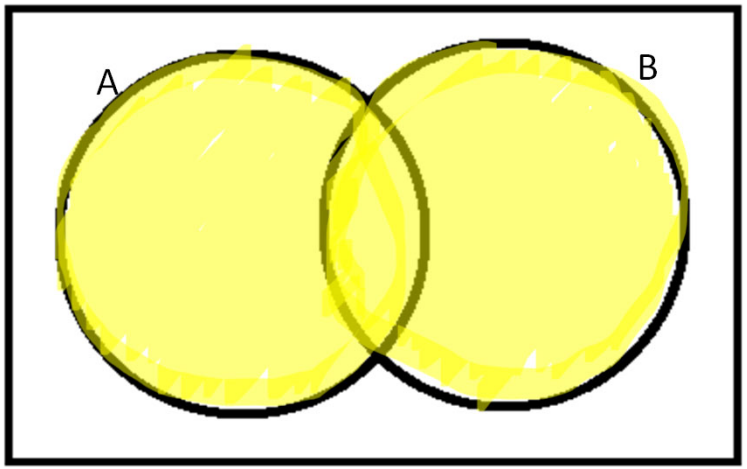
Venn Diagrams

These are also known as “circle diagrams,” and they can be used to represent sets.

Shade in $A \cap B$ (and)



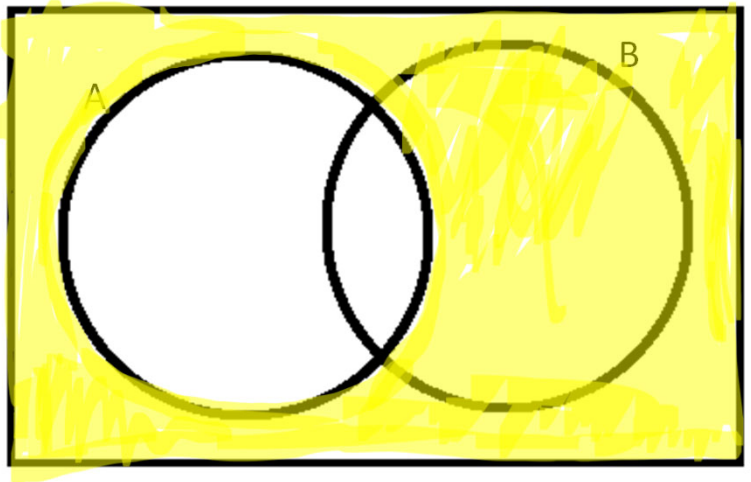
Shade in $A \cup B$ (or)



Venn Diagrams

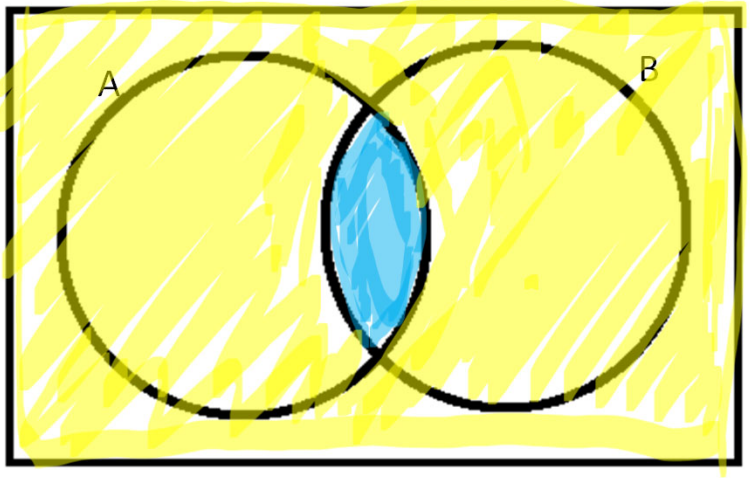
Shade in A^c

Not A



$(A \cap B)^c$

Answer: Yellow



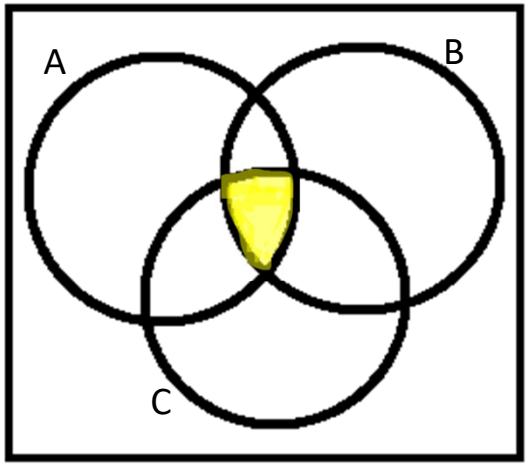
Venn Diagrams

A and B and C

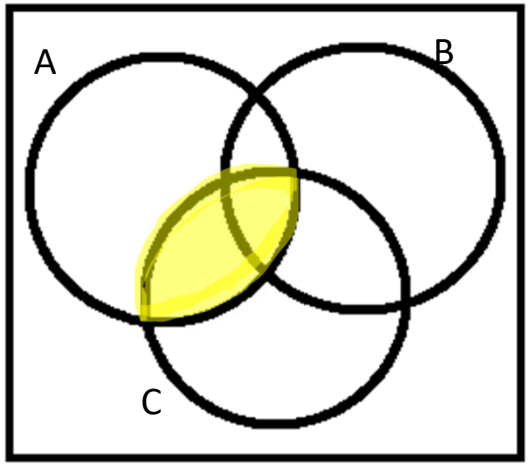
A and C

Shade in

A∩B∩C



A∩C



Application

Popper 01: Question numbers are in the diagram

a. 5 b. 10 c. 15 d. 20 e. 25

Draw a Venn Diagram for the following situation:

Q1: A
Q2: C
Q3: D
Q4: D
Q5: D

A group of 100 people are asked about their preference for soft drinks.

The results are as follows:

55 Like Coke 25 Like Diet Coke
45 Like Pepsi

15 like Coke and Diet Coke 5 Like all 3 soft drinks

25 Like Coke and Pepsi 5 Only like Diet Coke