

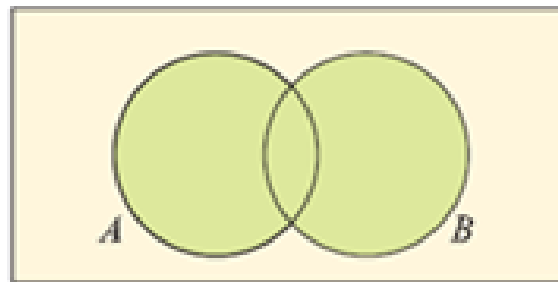
22H – Sets and Venn Diagrams

A Venn diagram consists of a universal set U (a rectangle) and sets, S , within it (circles).

U

The **complement** of a set, S , consists of all the members of U which are not in S .

Union:



$A \cup B$ is shaded green.

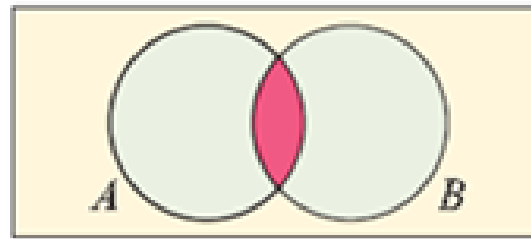
When Venn diagrams overlap, we say there is a **union** of the two sets, $A \cup B$.

\cup

Set notation: $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

(the set of all real x such that x belongs to A or B or both A and B)

Intersection:



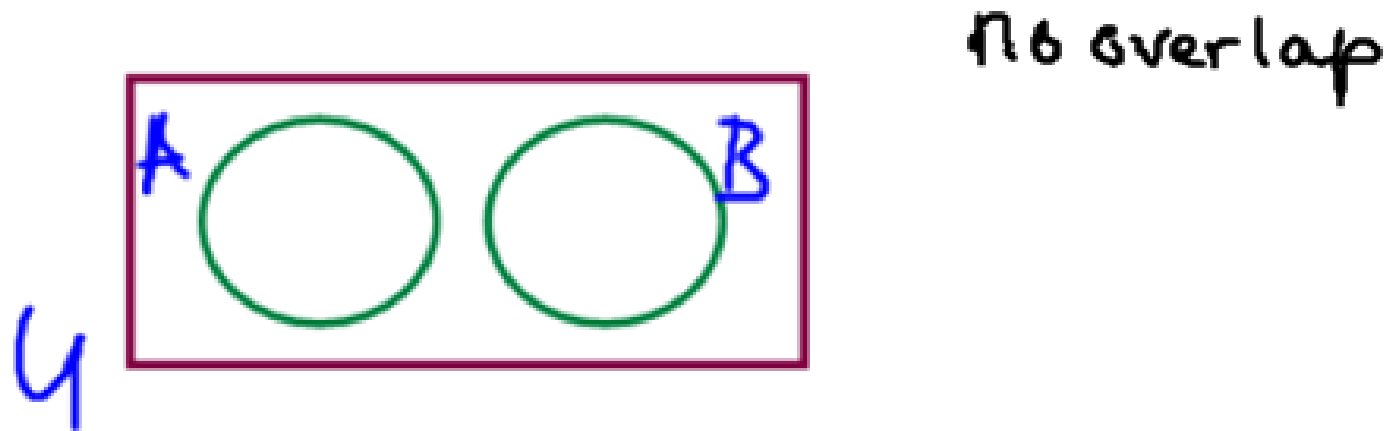
$A \cap B$ is shaded red. *overlap*

$A \cap B$ is the intersection of sets A and B . Contains only elements in both sets.

Set notation: $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$

Two sets are said to be **disjoint** if they have no elements in common:

$$A \cap B = \phi$$



If A and B have elements in common then they are **non-disjoint**.

Examples:

1. Given the following information:

$$U = \{x \mid 0 \leq x \leq 12, x \in N\}$$

$$A = \{\text{primes} < 12\}$$

$$B = \{\text{factors of } 12\}$$

(a) Find all elements in U . $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

(b) Find all elements in A . $\{2, 3, 5, 7, 11\}$

(c) Find all elements in B . $\{1, 2, 3, 4, 6, 12\}$

(d) Draw a Venn diagram.

(e) List the elements in:

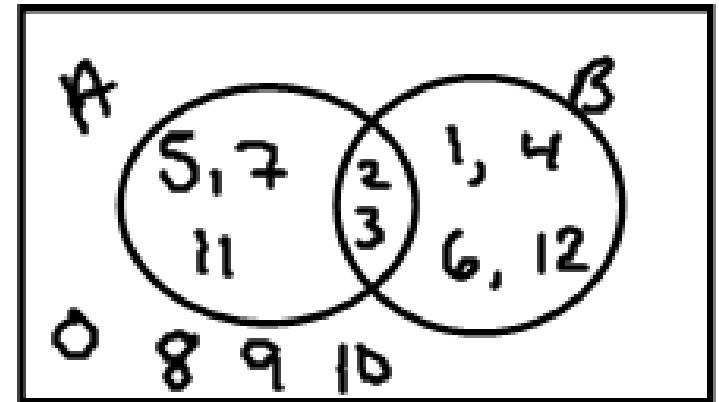
i. $A \cup B$

ii. $A \cap B$

iii. A'

$\{1, 2, 3, 4, 5, 6, 7, 11, 12\}$

(f) Find $n(B)$



(e) List the elements in:

i. $A \cup B$

ii. $A \cap B$

$$\{2, 3\}$$

iii. A'



complement

everything not
in A .

$$\{0, 1, 4, 6, 8, 9, 10, \emptyset\}$$

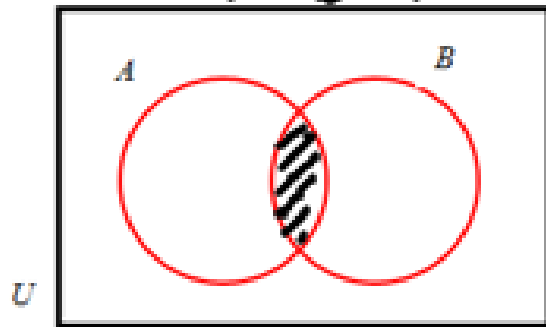
f) $n(B)$

\approx # of elements in set B

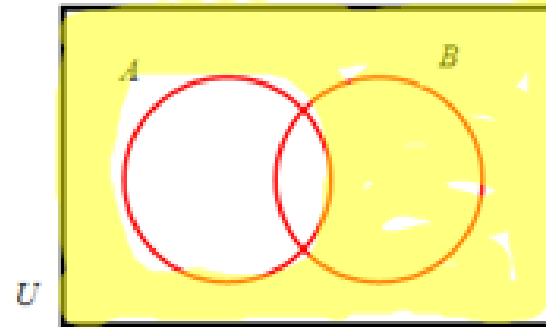
$$n(B) = 6$$

2. Verify: $(A \cap B)' = A' \cup B'$

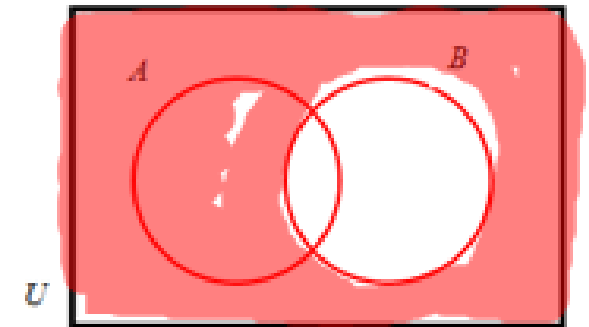
↑
Intersect



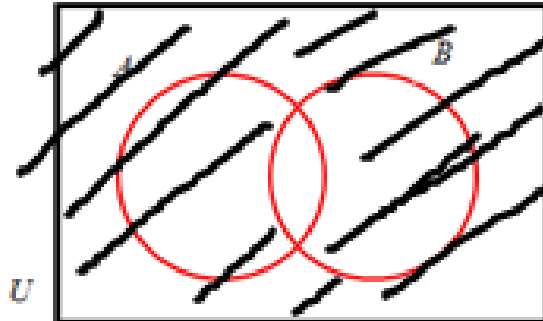
$A \cap B$



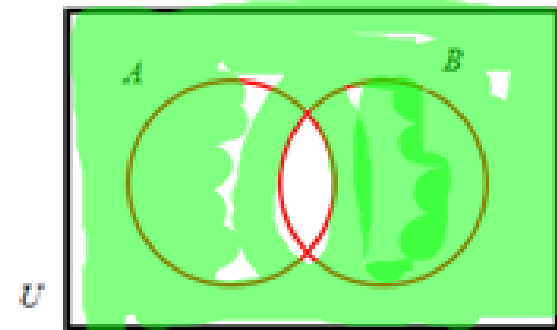
A'



B'



$(A \cap B)'$



$A' \cup B'$

↔
These are
the same
so $(A \cap B)' = A' \cup B'$

3.

(a) How many students take Chorus?

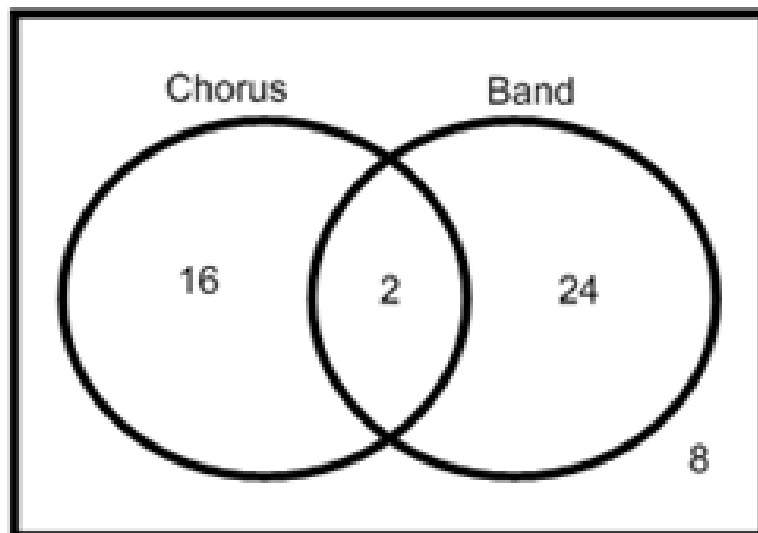
18

(b) How many students take Band?

26

(c) How many students are not enrolled in either class?

8

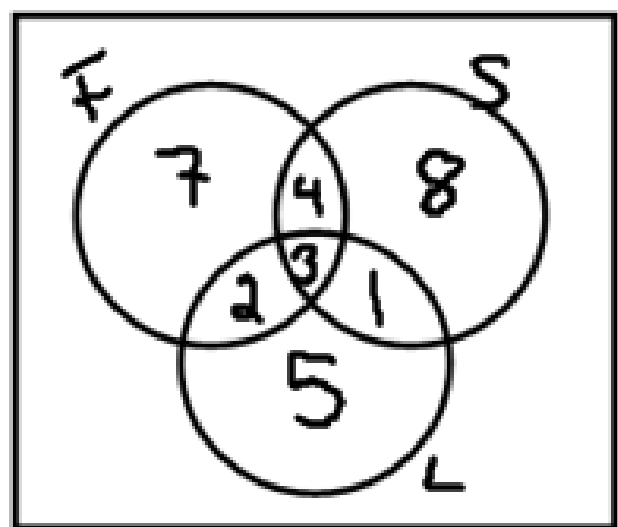


(d) How many students are there in total?
 $16 + 2 + 24 + 8 = 50$

(e) Determine the probability that a student takes both chorus and band.
 $\frac{2}{50}$

(f) Determine the probability that a student takes at least one of chorus or band.
 $\frac{16 + 2 + 24}{50} = \frac{42}{50}$

4. A guidance counsellor is planning schedules for 30 students. 16 students say they want to take French, 16 want to take Spanish, and 11 want to take Latin. 5 say they want to take both French and Latin, 7 students want to take French and Spanish, and 4 students say they want to take Latin and Spanish. Determine the probability a student takes exactly one language.



$$\text{Universe} = 30$$

$$\text{French} = 16$$

$$\text{Spanish} = 16$$

$$\text{Latin} = 11$$

$$43$$

- There are only 30 students, 13 will take more than 1 language.

$$F + L = 5$$

$$F + S = 7$$

$$L + S = 4$$

$$16$$

→ There are only 13 students taking more than 1 language. 3 take all 3 languages

$$P(1 \text{ lang}) = \frac{7 + 8 + 5}{30}$$

$$= \frac{20}{30}$$