

Note that the number of elements in a subset plus its complement must equal the universal set.

$$n(R) + n(R') = n(U)$$

$$26 + 26 = 52$$

# of red cards      # of not red cards      # of cards in deck.

When two sets are disjoint, the number of elements in either of them is the sum of the number in both of them.

$$n(R) + n(B) = n(R \text{ or } B)$$

$$26 + 26 = 52$$

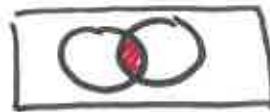
# of red cards      # of black cards      # of cards that are either red or black.

### 3.2 – Exploring Relationships Between Sets

Date: Feb. 5

When sets are not disjoint (i.e. there are elements in common), we have to have ways of describing how the sets relate to one another.

Two words have specific meaning when dealing with sets: **AND** and **OR**.



**AND**: To use 'and' means we want the elements that are elements of both sets.

**OR**: To use 'or' means we want the elements of one set, the elements of the other set, and the elements that are in both sets.



**Example:** Given the following sets, create a Venn Diagram to show their relationships.

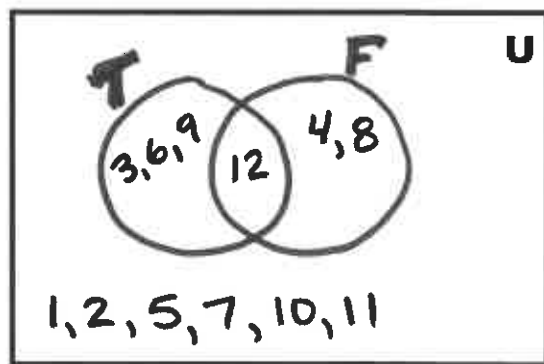
$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

$$T = \{3, 6, 9, 12\}$$

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

How many elements are in both?

$$n(T \text{ and } F) = 1$$



$$n(T \text{ or } F) = 6$$

**Example:** Given the following sets, create a Venn Diagram to show their relationships.

$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

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

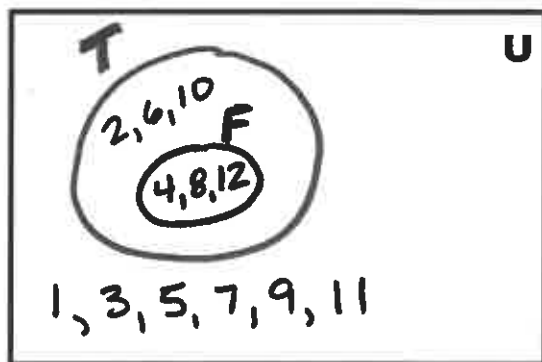
$$F = \{4, 8, 12\}$$

How many elements are in both?

Find  $n(T \text{ only})$

$$n(\underline{T \text{ and } F}) = 3$$

$$n(T \text{ only}) = 3$$



**Example:** Penelope surveyed 100 students about subjects they enjoy in school. 36 said they enjoyed science, 30 said it was French, and 40 said it was neither French nor science.

a. Construct a Venn Diagram to represent these results.

b. How many students enjoy only science?

$$36 - 6 = 30$$

enjoy science ↑  
enjoy both ↑

c. How many students enjoy only French?

$$30 - 6 = 24$$

enjoy French ↑  
enjoy both ↑

d. How many students enjoy both science and French?

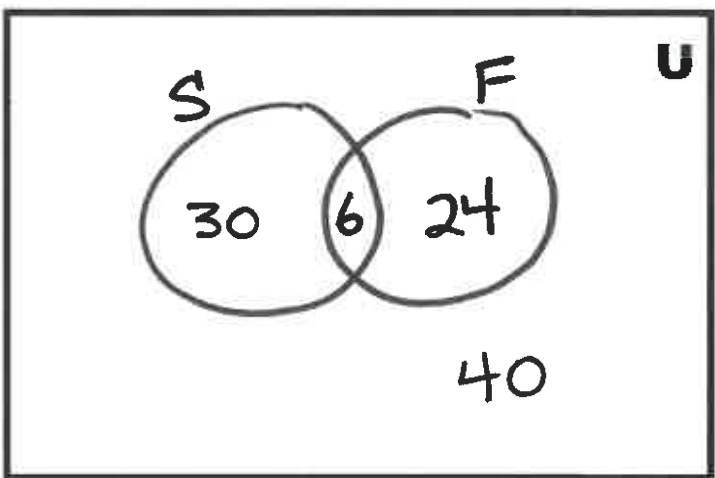
$$6$$

e. How many students enjoy science or French?

$$30 + 24 + 6 = 60$$

Science only ↑  
French only ↑  
both ↑

$36 + 30 + 40 = 106$  we have overlap!  
 $106 - 100 = 6$  chose both



**Example:** There are 56 students on senior sports teams. The Venn Diagram below shows the basketball (B) and volleyball (V) number of players.

- a. How many play basketball but not volleyball?

16

- b. How many play volleyball but not basketball?

6

- c. How many play both?

10

- d. How many play neither?

$$56 - 16 - 6 - 10 = 24$$

- e. How many basketball players are there? How many volleyball players?

B:  $16 + 10 = 26$  basketball players

V:  $6 + 10 = 16$  volleyball players.

- f. How many play either basketball or volleyball?

$$16 + 6 + 10 = 32$$

