

## Welcome MYP 9 Mathematics!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
<b>Monday</b> Date: <b>5-21</b> Topic: <b>Venn Diagrams Day 1</b>	0 1 2	
<b>Tuesday</b> Date: _____ Topic: _____	0 1 2	
<b>Wednesday</b> Date: _____ Topic: _____	0 1 2	
<b>Thursday</b> Date: _____ Topic: _____	0 1 2	
<b>Friday</b> Date: _____ Topic: _____	0 1 2	

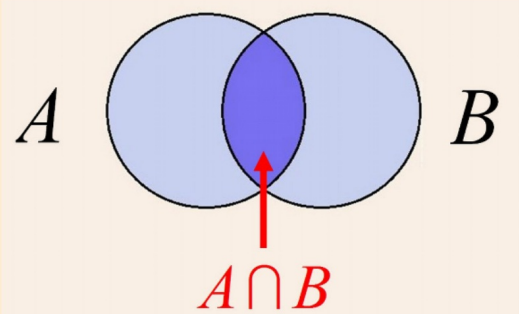
## Class Plan

1) Warm-up

2) Real-life Venn Diagrams

Investigation: How can we find the intersection?

3) Practice



# SET NOTATION

$\cap$ : INTERSECTION  
(AND / BOTH)

$\cup$ : UNION (EITHER OR)

$A'$ : COMPLEMENT (NOT)

Chapter

3

## Sets and Venn diagrams

- Contents:**
- A Sets
  - B Special number sets
  - C Interval notation
  - D Complement of a set
  - E Venn diagrams
  - F Problem solving with Venn diagrams

Chapter

14

## Probability

- Contents:**
- A Experimental probability
  - B Probabilities from tabled data
  - C Sample space
  - D Theoretical probability
  - E Using 2-dimensional grids
  - F Compound events
  - G Using tree diagrams
  - H Sampling with and without replacement
  - I Probabilities from Venn diagrams
  - J Expectation



## What do you notice? Wonder?

- 11 set Venn Diagram
- Picture on wall of Olin-Rice building at Macalester College



In what number of sets do Venn diagrams produce rotational symmetry?



The number of sets must be a prime number.

(Primes < 100)

PRIME NUMBERS									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

**Theorem.** If a symmetric  $n$ -Venn diagram exists, then  $n$  is prime.

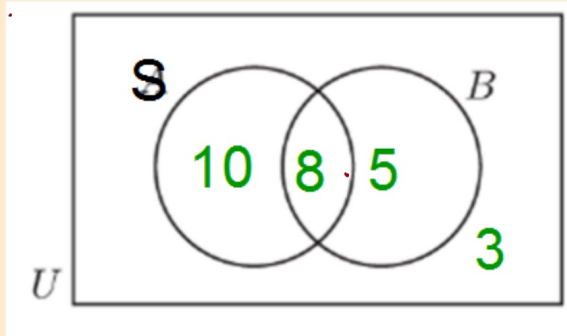
<http://stanwagon.com/public/venndiagramsandprimes.pdf>

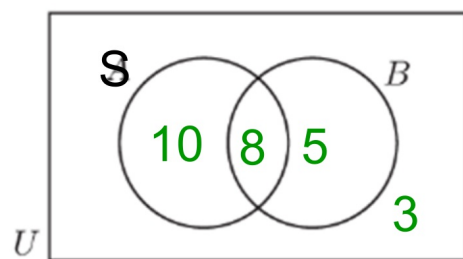
## Warm-up:

Find the value and write the solution in a sentence about a group of students and their interest in soccer and basketball.



$$\begin{aligned} S \cap B &= \underline{8} \text{ "who like both B and S"} \\ S \cup B &= \underline{23} \\ (S \cup B)' &= \underline{3} \\ S' &= \underline{8} \\ B' &= \underline{13} \end{aligned}$$





$S \cap B = \underline{8}$  students like both soccer and basketball

$S \cup B = \underline{23}$  students like either soccer or basketball

$(S \cup B)' = \underline{3}$  students don't like soccer or basketball

$S' = \underline{8}$  students don't like soccer

$B' = \underline{13}$  students don't like basketball

## Example 1: AP Human Geography & Math

\*At your table...Interpretate the Venn Diagram and use Set Notation (Introduced Thursday!)

1) A group of students were surveyed about the classes they liked this year.

a. How many students responded to the survey? \_\_\_\_\_

Notation: \_\_\_\_\_ (Add this to your diagram)

b. How many students liked AP Human Geography? \_\_\_\_\_

Notation: \_\_\_\_\_

c. How many students did not like Math? \_\_\_\_\_

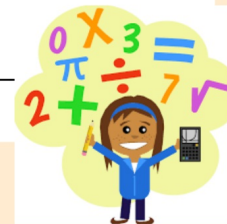
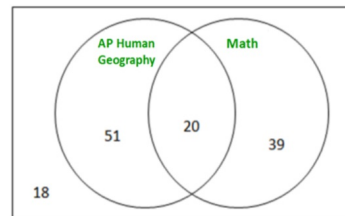
Notation: \_\_\_\_\_

d. How many students liked **both** Math **and** AP Human Geography? \_\_\_\_\_

Notation: \_\_\_\_\_

e. How many students did not like **either** Math **or** AP Human Geography? \_\_\_\_\_

Notation: \_\_\_\_\_



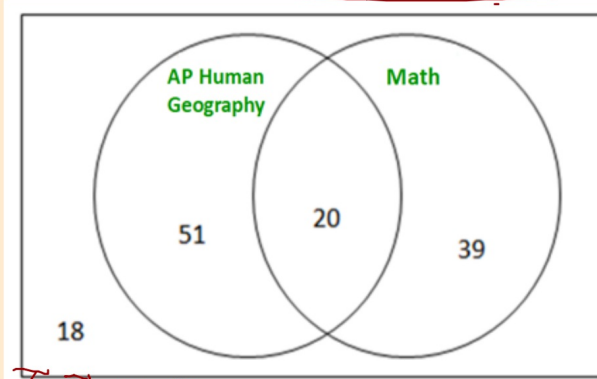
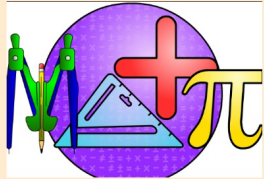
## Example 1: AP Human Geography & Math

1) A group of students were surveyed about the classes they liked this year.

### Sample Space

a. How many students responded to the survey? 128

Notation: U (Add this to your diagram)



$$U = 128$$

## Example 1: AP Human Geography & Math Like Geography

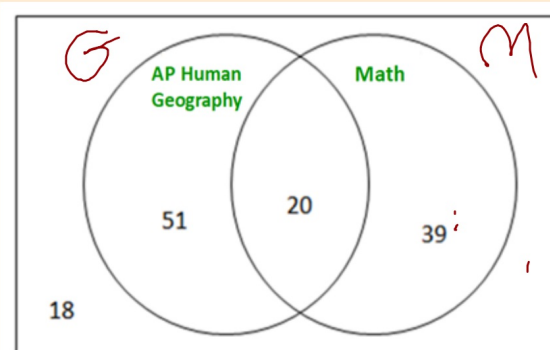
b. How many students liked AP Human Geography? 71

Notation: G

## Do not like Math

c. How many students did not like Math? 69

Notation: M'



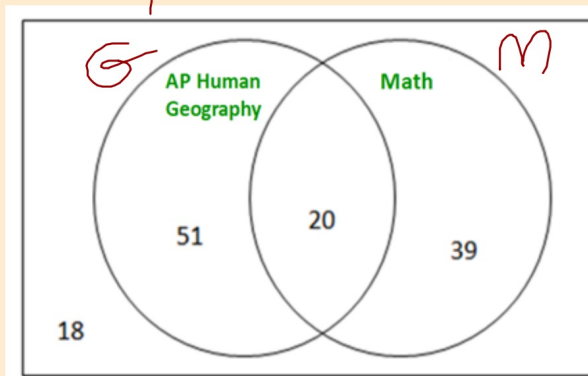
# 1): AP Human Geography & Math AND vs. OR

d. How many students liked **both** Math **and** AP Human Geography? 20

Notation: G ∩ M

e. How many students did not like **either** Math **or** AP Human Geography? 18

Notation: (G ∪ M)ᶜ



$$U = 128$$



## Example 1: AP Human Geography & Math

\*At your table... Interpretate the Venn Diagram and use Set Notation (Introduced Thursday!)

1) A group of students were surveyed about the classes they liked this year.

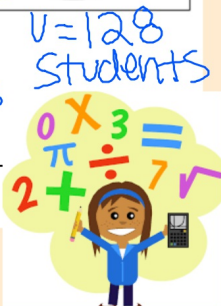
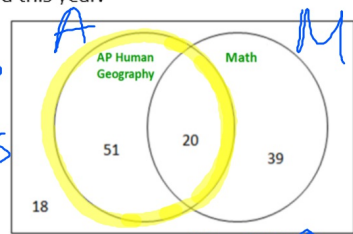
a. How many students responded to the survey? 128 students  
Notation:  $V$  (universe - sample space) (Add this to your diagram)

b. How many students liked AP Human Geography? 71 students  
Notation: Set A

c. How many students did not like Math? 69 students  
Notation:  $M'$

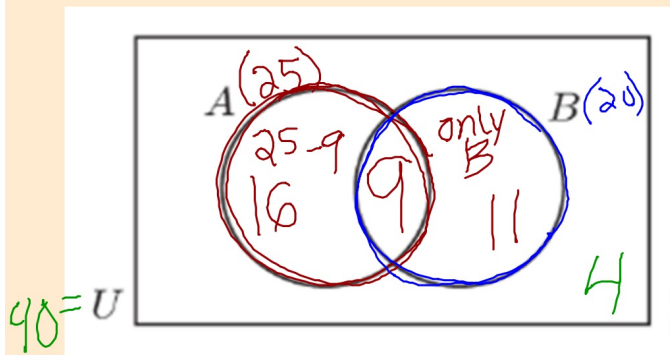
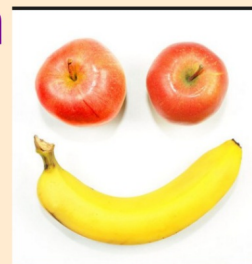
d. How many students liked both Math and AP Human Geography? 20 students  
Notation:  $A \cap M$

e. How many students did not like either Math or AP Human Geography? 18 students  
Notation:  $(A \cup M)'$



## Example 2: Who likes both Apples & Bananas?

- 40 students were surveyed.
- 25 students enjoy apples (set **A**)
- 20 students enjoy bananas (set **B**)
- 4 students do not like either fruit.



Circles Union  $A \cup B$

$4 = 40$

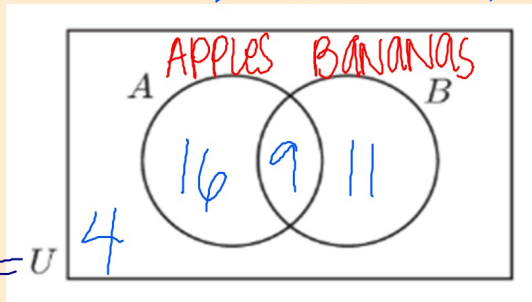
$$A \cup B = 36$$

$$25 + 20 - 36 = 9$$

## Example 2: Apples & Bananas

- 40 students were surveyed.
- 25 students enjoy apples (set **A**)
- 20 students enjoy bananas (set **B**)
- 4 students do not like either fruit.

$$A \cup B = 40 - 4 = 36$$
$$(25 + 20) - 36 = 9$$



40 = U  
4  
STUDENTS

### Big Question:

How many students like both apples and bananas?



## Calculating the Intersection

### Big Question:

How many students like both apples & bananas?

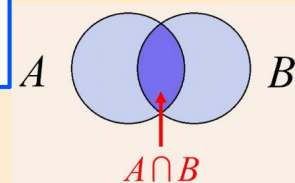
Investigate!

i) How can we calculate the intersection?

Subtracted neither from universe =  $A \cup B$

ii) What is a formula that we can use to calculate the intersection?

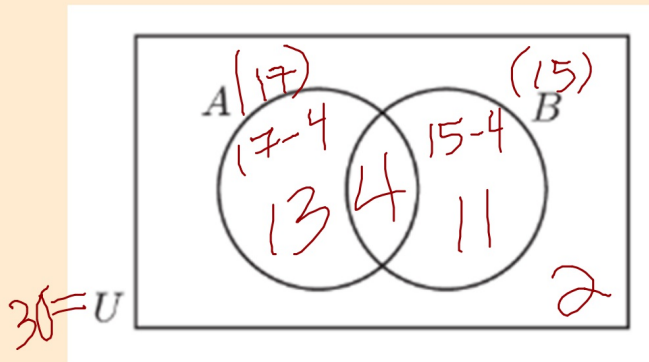
$$A + B - A \cup B = A \cap B$$



## Example 1: Who brushes their teeth before and after breakfast?

- 30 people were surveyed.
- 17 Brush teeth ~~before~~<sup>after</sup> breakfast (set A)
- 15 Brush teeth before breakfast (set B)
- 2 don't brush teeth in the morning.

Universe - neither  
 $A \cup B = 30 - 2 = 28$



$$17 + 15 = 32$$
$$32 - 28 = 4$$
$$A \cap B = 4$$

## Example 1: Brushing Teeth

Probability Question:

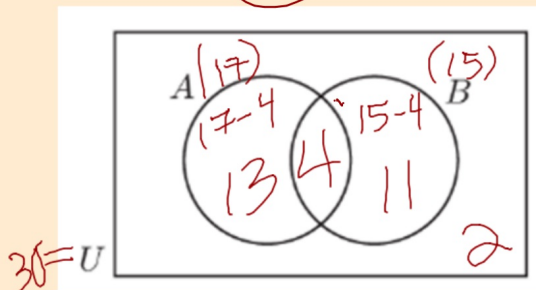
1) Find the probability of a student randomly selected from those surveyed does not brush their teeth before breakfast.

$$P(B') = \frac{15}{30} = \frac{1}{2} = 50\%$$

2) Find  $P(A \cup B)'$  =  $\frac{2}{30}$ . Interpret this notation: \_\_\_\_\_

$$= \frac{1}{15}$$

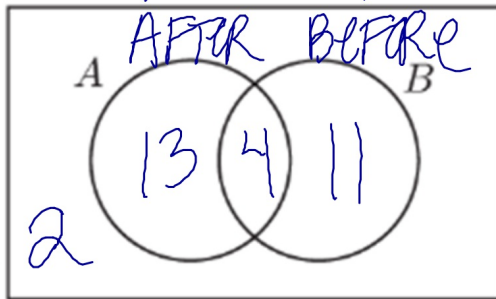
Probability of students who don't brush before or after breakfast.



## Example 1: Brushing Teeth

- 30 people were surveyed.
- 17 Brush teeth ~~before~~<sup>after</sup> breakfast (set A)
- 15 Brush teeth before breakfast (set B)
- 2 don't brush teeth in the morning.

$$A \cup B = 30 - 2 = 28$$
$$(17 + 15) - 28 = 4$$



30 = U  
People

Big Question:

How many students brush before and after ?

4

Stay fresh!

## Example 1: Brushing Teeth

Probability Question:

1) Find the probability of a student randomly selected from those surveyed does not brush their teeth before breakfast.

$$P(B') = \frac{15}{30} = \frac{1}{2}$$

2) Find  $P(A \cup B)' = \frac{1}{15}$ . Interpret this notation: \_\_\_\_\_

$$\frac{2}{30}$$

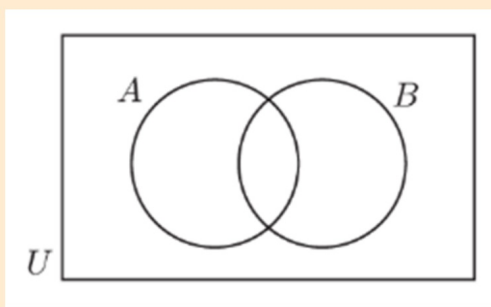
2 students  
do not brush  
their teeth in  
the AM!! AHH!  
(no time...?)



## Example 2: Who plays both Guitar & Piano?



- 54 people were surveyed.
- 21 people play guitar (set **A**)
- 37 people play piano (set **B**)
- 14 people do not play either instrument.



### Probability Question:

1) Find the probability of randomly selecting a student who plays piano.

Interpret this notation

2) Find  $P(A \cap B') = \underline{\hspace{2cm}}$ .

## Example 2: Guitar & Piano



Probability Question:

1) Find the probability of randomly selecting a student who plays piano.

2) Find  $P(A \cap B')$  = \_\_\_\_\_.

Interpret this notation

## Example 2: Guitar & Piano

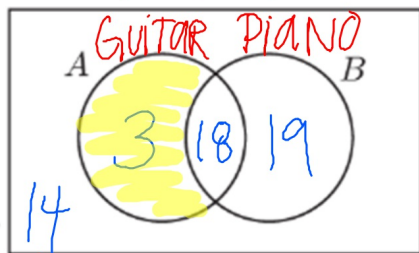
- 54 people were surveyed.
- 21 people play guitar (set A)
- 37 people play piano (set B)
- 14 people do not play either instrument.

$$U - (A \cup B) = 14$$

$$54 - 14 = 40$$

$$A + B - (A \cup B)$$

$$(21 + 37) - (40) = 18$$



40 people

2) Find  $P(A \cap B) = \frac{18}{40}$ .



### Big Question:

How many students play both guitar and piano?

### Probability Question:

1) Find the probability of randomly selecting a student who plays piano.

$$P(P) = \frac{37}{40}$$

### Interpret this notation

Probability of students who only play guitar.

### 3 Set Venn: Entertainment Equipment

For a class project, Diana surveys 300 students at her high school about the entertainment equipment (CD players, VCRs, and DVD players) they have in their homes. She gathers the following information.

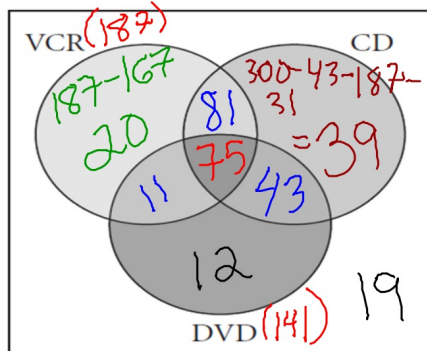
- 187 homes had VCRs and 141 homes had DVD players.
- 19 homes had no entertainment equipment, while 12 homes had DVD players only.
- 81 homes had VCRs and CD players, but not DVD players.
- 11 homes had VCRs and DVD players, but not CD players.
- 43 homes had CD players and DVD players, but not VCRs.

a. Complete the Venn diagram.

b. What is the probability that student's home has a CD player, but neither a VCR nor a DVD player?

$$\frac{39}{300} = \frac{13}{100}$$

Notation:  $P(C \cap V' \cap D')$



$$\begin{aligned}
 (V \cup D \cup C)' &= 19 & V \cap D \cap C &= 43 \\
 V \cap C \cap D &= 12 & V \cap D \cap C &= 75 \\
 V \cap D \cap C &= 81 & (141 - 66) & \\
 V \cap D \cap C &= 11 & V \cap D \cap C' &= 20 \\
 U &= 300 & V \cap D \cap C &= 39
 \end{aligned}$$

### 3 Set Venn: Entertainment Equipment

For a class project, Diana surveys 300 students at her high school about the entertainment equipment (CD players, VCRs, and DVD players) they have in their homes. She gathers the following information.

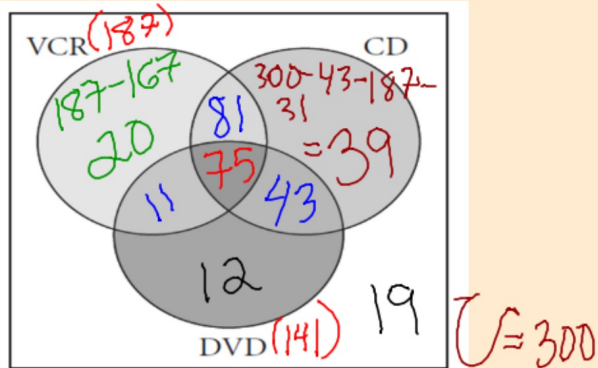
187 homes had VCRs and 141 homes had DVD players.

19 homes had no entertainment equipment, while 12 homes had DVD players only.

81 homes had VCRs and CD players, but not DVD players.

11 homes had VCRs and DVD players, but not CD players.

43 homes had CD players and DVD players, but not VCRs.



c. What is the probability that a student's home has all three electronics?

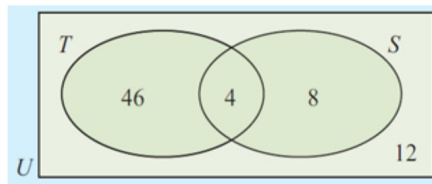
$$P(V \cap D \cap C) = \frac{75}{300}$$

$$= \frac{1}{4} = 25\%$$

Notation: \_\_\_\_\_

## Exercises:

1) The Venn diagram below shows the number of passengers on an airplane who watched television (SET T) and those passengers who slept (SET S) while on the airplane.



a) How many passengers were on the flight? \_\_\_\_\_

Notation \_\_\_\_\_

b) How many passengers slept OR watched television? \_\_\_\_\_

Notation \_\_\_\_\_

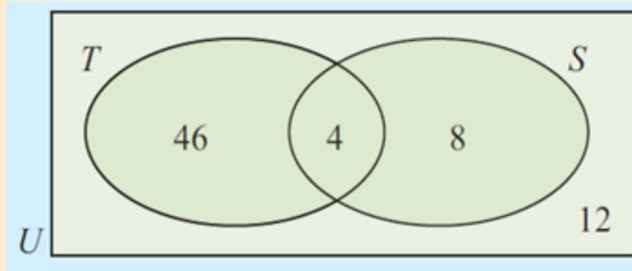
c) How many passengers did not sleep? \_\_\_\_\_

Notation \_\_\_\_\_

d) How many passengers did something other than sleep or watch tv.? \_\_\_\_\_

Notation \_\_\_\_\_

## Exercises:



**A passenger is selected at random from the survey responders. Find the probability that...**

- a) The person slept on the plane.
- b) The person *did not* sleep on the plane.

**Two passengers are selected at random from the survey responders. Find the probability that...**

- c) The first person slept, but the second person did not sleep nor watch TV on the plane.

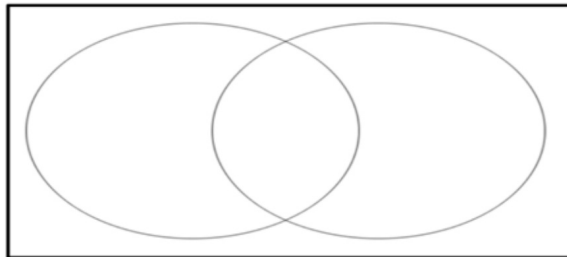
## Exercises:

2) Use the rule we wrote in class to complete the Venn diagram.

There are 60 senior students in a school. Each of these students studies History, Geography or both of these subjects. 38 students study History, 31 study Geography and  $n$  study both.

- a Find the value of  $n$ .
- b Draw a fully labelled Venn diagram to illustrate this information.

$U =$

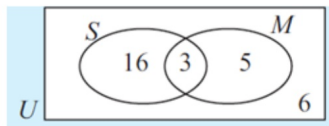


- c Find the probability that a student selected at random studies only one of these subjects. (In other words, only studies history or only studies geography)



## Exercises:

3) Students were asked if they spend their spare time playing sports (**SET S**) or playing a musical instrument (**SET M**).



a) How many students were surveyed?

Notation \_\_\_\_\_

b) How many students do not play an instrument or play sports? How can you explain this situation?

c) How many students play sports and an instrument?

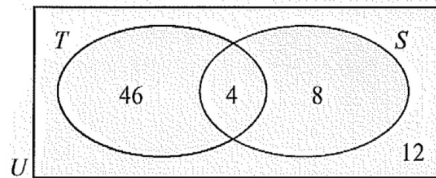
**Two students are randomly selected from the survey responders. Find the probability that....**

a) The first person plays a musical instrument and the second person plays sports.

b) The first person plays sports, but the second person does not play sports and does not play a musical instrument.

## Exercise Solutions

1) The Venn diagram below shows the number of passengers on an airplane who watched television (SET T) and those passengers who slept (SET S) while on the airplane.



a) How many passengers were on the flight? 70  $12 + 46 + 4 + 8$   
Notation  $U = 70$  PASSENGERS

b) How many passengers slept OR watched television? 58  $46 + 4 + 8$   
Notation  $S \cup T$  PASSENGERS

c) How many passengers did not sleep? 58  $46 + 12$   
Notation  $S'$

d) How many passengers did something other than sleep or watch tv.? 12  
Notation  $(S \cup T)'$

## Exercise Solutions

A passenger is selected at random from the survey responders. Find the probability that....

a) The person slept on the plane.  $P(S) = \frac{12}{70} = \frac{6}{35}$

b) The person *did not* sleep on the plane.  $P(S') = \frac{58}{70} = \frac{29}{35}$

Two passengers are selected at random from the survey responders. Find the probability that....

c) The first person slept, but the second person did not sleep nor watch TV on the plane.

$$P(S \cap (SUT)') = \left(\frac{12}{70}\right)\left(\frac{12}{70}\right) = \frac{144}{4900}$$

## Exercise Solutions

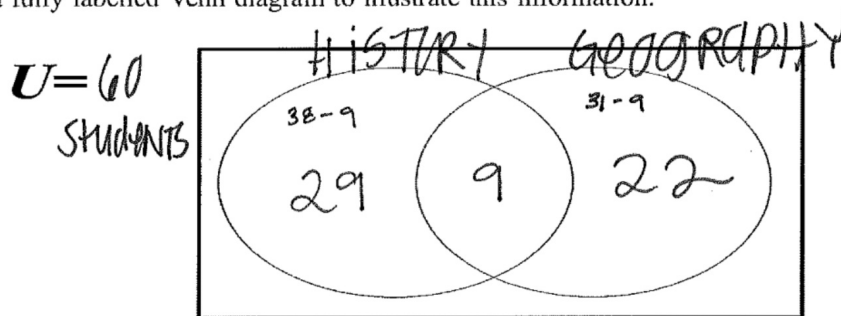
2) Use the rule we wrote in class to complete the Venn diagram.

There are 60 senior students in a school. Each of these students studies History, Geography or both of these subjects. 38 students study History, 31 study Geography and  $n$  study both.

$$38 + 31 = 69 \therefore 9 \text{ MUST STUDY BOTH}$$

a Find the value of  $n$ .

b Draw a fully labelled Venn diagram to illustrate this information.

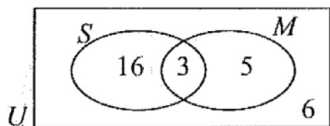


c Find the probability that a student selected at random studies only one of these subjects.  
(In other words, only studies history or only studies geography)

$$P(\text{ONLY H OR ONLY G}) = \frac{29}{60} + \frac{22}{60} = \frac{51}{60}$$

## Exercise Solutions

3) Students were asked if they spend their spare time playing sports (**SET S**) or playing a musical instrument (**SET M**).



a) How many students were surveyed?

Notation  $U = 30$  STUDENTS

b) How many students do not play an instrument or play sports? How can you explain this situation?

$(S \cup M)' = 6$  STUDENTS since?

c) How many students play sports and an instrument?

$S \cap M = 3$  STUDENTS

Two students are randomly selected from the survey responders. Find the probability that....

a) The first person plays a musical instrument and the second person plays sports.

$$P(M, S) = \cancel{P(M)} P(S|M) = P\left(\frac{5}{30}\right)\left(\frac{19}{30}\right) = \frac{95}{900} = \frac{19}{180}$$

b) The first person plays sports, but the second person does not play sports and does not play a musical instrument.

$$P(S, (S \cup M)') = P\left(\frac{19}{30}\right)\left(\frac{6}{30}\right) = \frac{114}{900} = \frac{19}{150}$$