

Welcome MYP 9 Mathematics!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 5-21 Topic: 3E.1 & 3E.2 Venn Diagrams	0 1 2	
Tuesday Date: _____ Topic: _____	0 1 2	
Wednesday Date: _____ Topic: _____	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

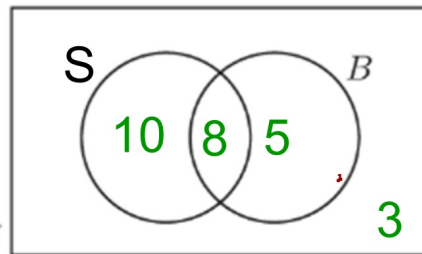
Warm-up:

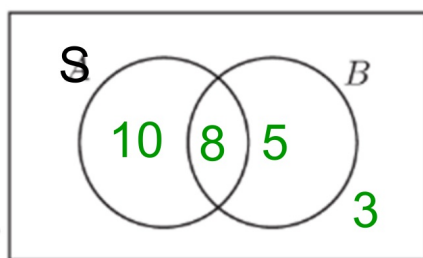
Find the value and write the solution in a sentence about a group of students and their interest in soccer and basketball.



$$\begin{aligned} S \cap B &= \overset{\text{and}}{\underline{8}} \\ S \cup B &= \overset{\text{OR}}{\underline{23}} \\ (S \cup B)' &= \overset{\text{NOT either}}{\underline{3}} \\ S' &= \underline{8} \\ B' &= \underline{13} \end{aligned}$$

$$26 = U$$





26 = U
Students



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

$S \cup B = \underline{23}$ students **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

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>

Class Plan

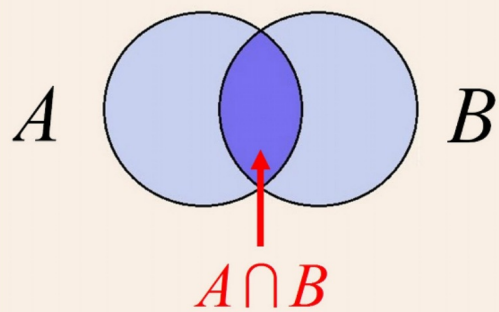
1) Warm-up

2) Real-life Venn Diagrams

Investigation: How can we find the intersection?

-Examine 3-set Venn diagrams

3) Practice



Textbook Support for Venn Diagrams

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

Example: 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? _____

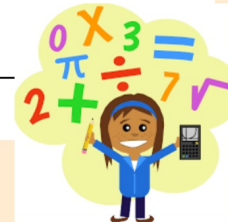
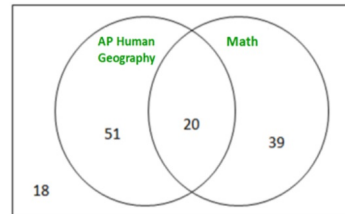
Notation: _____

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: AP Human Geography & Math

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

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

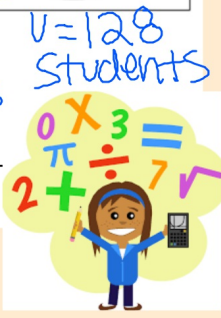
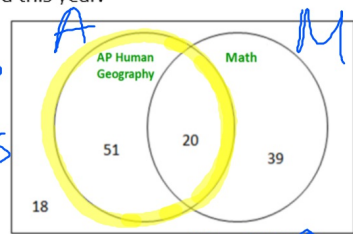
a. How many students responded to the survey? 128 students
 Notation: V (universe - sample space) (Add this to your diagram)

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: $(A \cup M)'$



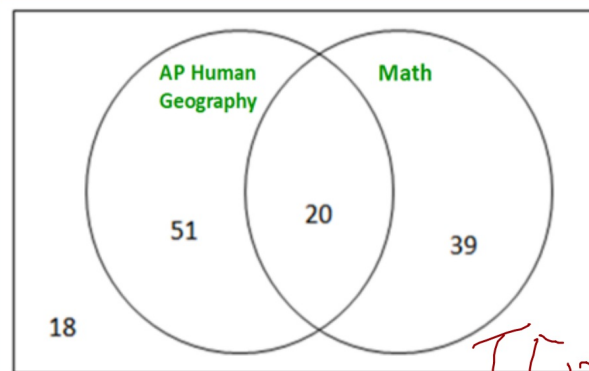
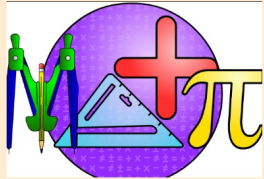
Example: AP Human Geography & Math

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: AP Human Geography & Math Like Geography

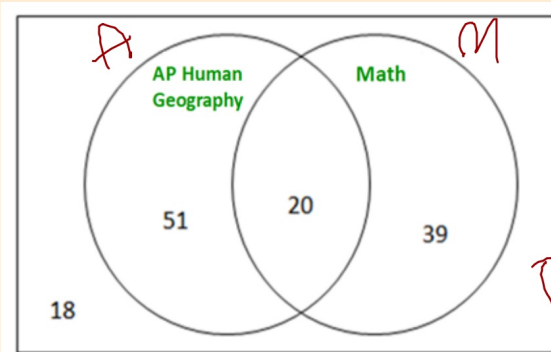
b. How many students liked AP Human Geography? 71

Notation: A

Do not like Math

c. How many students did not like Math? 69

Notation: M'



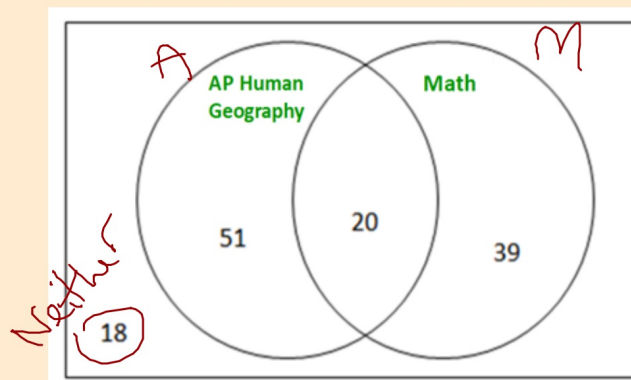
Example: AP Human Geography & Math AND vs. OR

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

Notation: AM

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

Notation: (AUM)



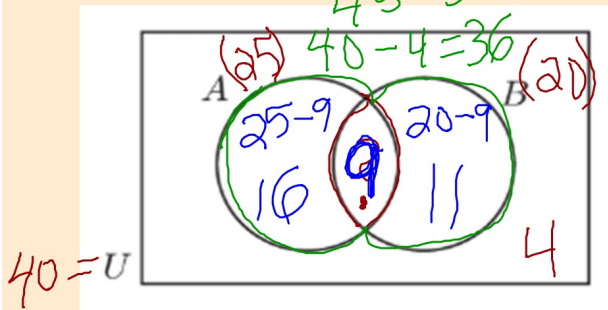
Example: Apples & Bananas

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

Big Question:

How many students like both apples and bananas? 9

$$36 = A \cup B$$
$$45 - 36 = 9$$
$$40 - 4 = 36$$



Calculating the Intersection

Big Question:

How many students like both apples & bananas?

Investigate!

i) How can we calculate the intersection?

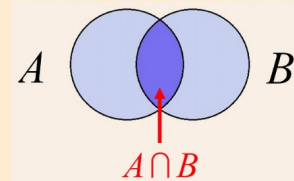
Find how many students like apples or bananas (subtract neither from the sample), add all of A and B, subtract A ∪ B to find overlap.

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

(All of circles)
Sample space - neither



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

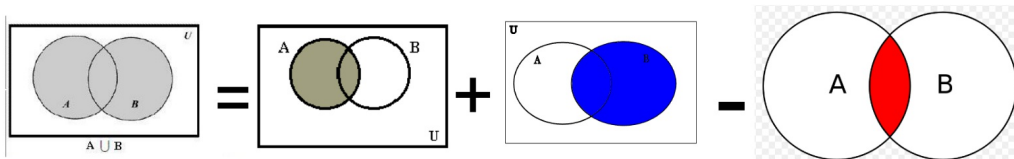




$$A + B - (A \cup B) = A \cap B$$

General Addition Rule for Unions of Two Events

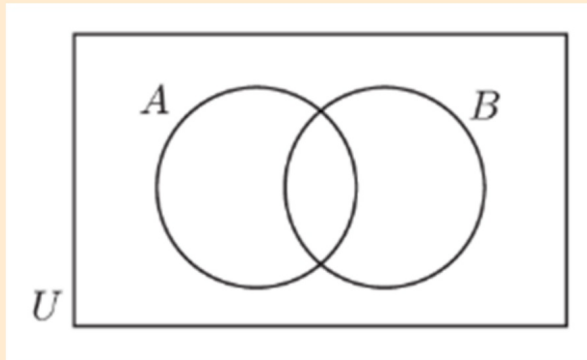
- For any two events A and B
 - $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
- Equivalently
 - $P(A \cup B) = P(A) + P(B) - P(A \cap B)$



Example 1: Brushing Teeth

- 30 people were surveyed.
- 17 Brush teeth ~~before~~ ^{after} breakfast (set **A**)
- 15 Brush teeth before breakfast (set **B**)
- 2 don't brush teeth in the morning.

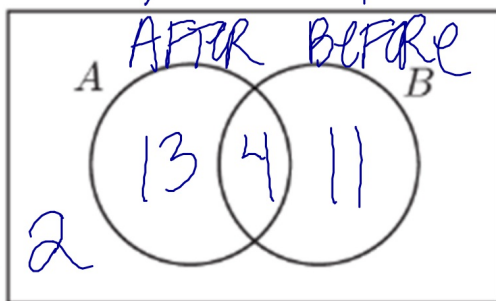
Big Question:
How many students
brush before and
after ?



Example 1: Brushing Teeth

- 30 people were surveyed.
- 17 Brush teeth ~~before~~^{after} 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.

2) Find $P(A \cup B)'$ = _____. Interpret this notation: _____

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: 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.

$$V = 187 \quad D = 141$$

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.

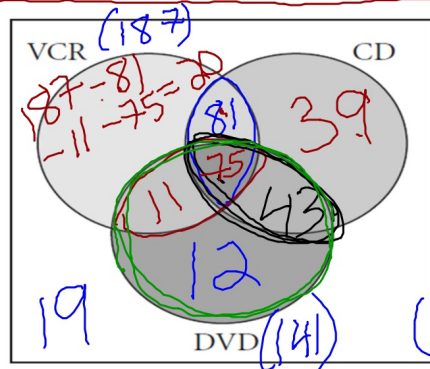
a. Complete the Venn diagram.

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

$$141 - 11 - 12 = 43$$

$$141 - 66 = 75$$

Notation: _____



$$C \cap V \cap D = 12$$

$$V \cap C \cap D' = 81$$

$$V \cap D \cap C' = 11$$

$$C \cap D \cap V' = 43$$

$$U = 300$$

Example 2: 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.

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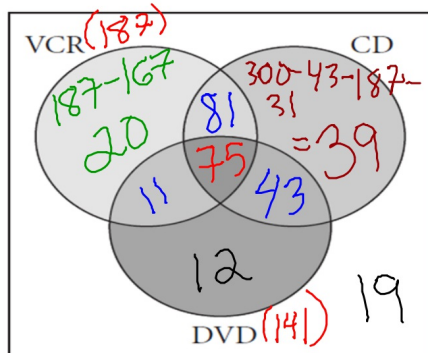
43 homes had CD players and DVD players, but not VCRs.

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



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

Example 2: 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.

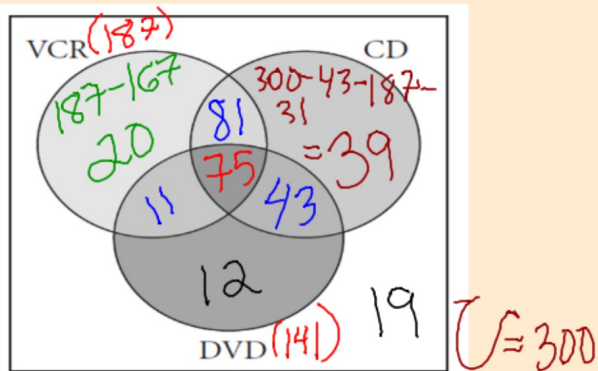
187 homes had VCRs and 141 homes had DVD players.

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?

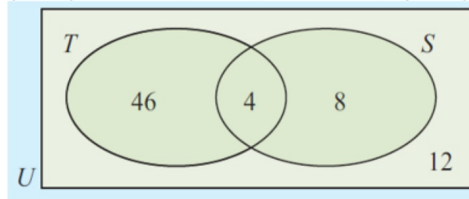
$$P(V \cap D \cap C) = \frac{75}{300}$$

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

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 slept **OR** watched tv.? _____

Notation _____

c) How many passengers did not sleep? _____ Notation _____

d) How many passengers did something other than sleep or watch tv.? _____ Notation _____

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

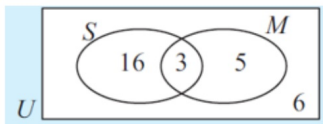
i) The person slept on the plane. _____ ii) The person *did not* sleep on the plane. _____

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

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

Exercises:

2) 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.

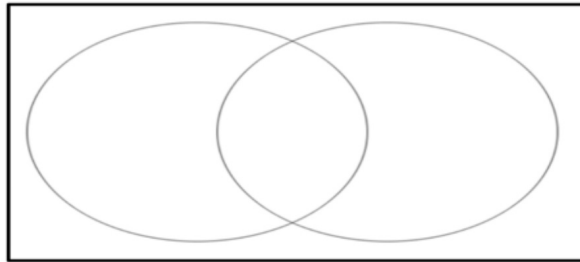
Exercises:

3) 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.

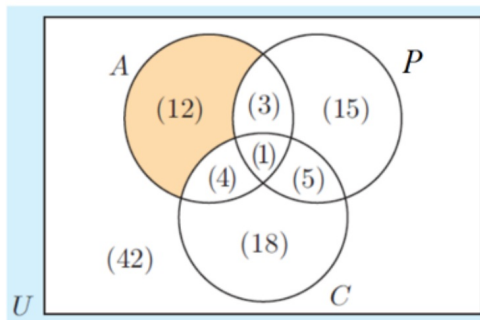
$U =$



- 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:

4) A group of 10th graders in drivers education were surveyed about which Honda car they would prefer. The 10th graders chose Accord (**SET A**), Prelude (**SET P**), or Civic (**SET C**), and they were asked to check all that would apply. The survey results are shown in the Venn diagram below.



a) How many 10th graders were surveyed?

b) How many 10th graders prefer an Accord **OR** a Civic?

c) How many 10th graders do not like either type of Honda?

d) Explain the region that is shaded in the diagram:

e) Find the probability of:

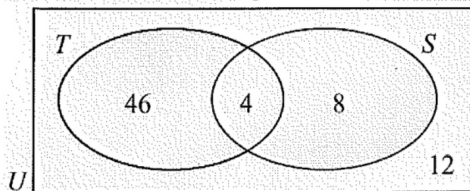
i. $P(A \cap C) =$

ii. $P(P') =$

iii. $P(A \cap P \cap C) =$

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

Notation U: Universe or Sample space

b) How many slept **OR** watched tv.? 58

Notation T U S

c) How many passengers did not sleep? 58

Notation S'

d) How many passengers did something other than sleep or watch tv.? 12 Notation (TUS)'

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

i) The person slept on the plane. $\frac{12}{70} = \frac{6}{35}$ ii) The person *did not* sleep on the plane. $\frac{58}{70} = \frac{29}{35}$

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

i) The person slept on the plane. $\frac{12}{70} = \frac{6}{35}$ ii) The person *did not* sleep on the plane. $\frac{58}{70} = \frac{29}{35}$

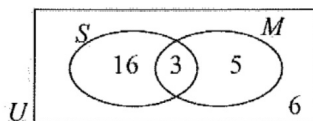
Two passengers are selected at random from the survey responders. Find the probability that...

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

$$\left(\frac{12}{70}\right)\left(\frac{12}{70}\right) = \frac{144}{4900} = \frac{36}{1225}$$

Exercise Solutions

2) 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 $30 = U$ universe
sample space

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?

$$S \cap M = 3$$

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.

$$P(M, S) = \frac{5}{30} \cdot \frac{19}{29} = \frac{95}{870} = \frac{19}{174}$$

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

$$P(S, (S \cup M)') = \frac{16}{30} \cdot \frac{6}{29} = \frac{16}{145}$$

Exercise Solutions

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

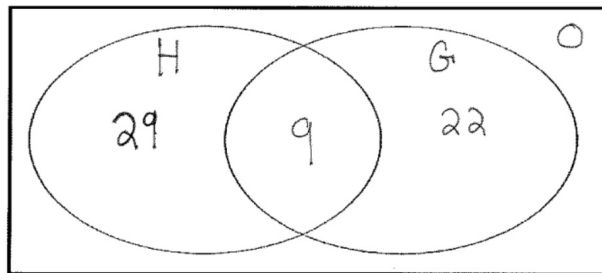
There are 60 senior students in a school. Each of these students studies History, Geography or both of these subjects. 38 students study History, 31 study Geography and n study both.

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

$$U = 60$$

$$38 + 31 = 69$$

$$69 - 60 = 9 = n$$



$$38 - 9 = 29$$

$$31 - 9 = 22$$

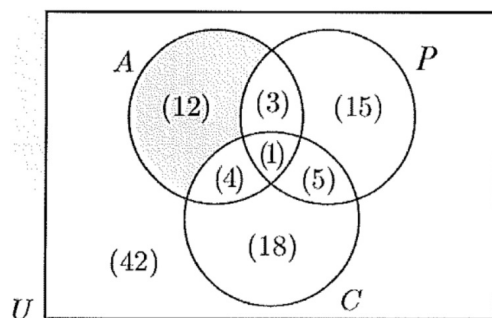
c) Find the probability that a student selected at random studies only one of these subjects.

(In other words, only studies history or only studies geography)

$$P(H \cap G' \text{ or } G \cap H') = \frac{29}{60} + \frac{22}{60} = \frac{51}{60} = \frac{17}{20}$$

Exercise Solutions

4) A group of 10th graders in drivers education were surveyed about which Honda car they would prefer. The 10th graders chose Accord (**SET A**), Prelude (**SET P**), or Civic (**SET C**), and they were asked to check all that would apply. The survey results are shown in the Venn diagram below.



a) How many 10th graders were surveyed?

100

b) How many 10th graders prefer an Accord **OR** a Civic? $12 + 3 + 1 + 4 + 5 + 18 = 43$

c) How many 10th graders do not like either type of Honda? any

42

d) Explain the region that is shaded in the diagram:

$$A \cap (P \cup C)$$

e) Find the probability of:

i. $P(A \cap C) = \frac{5}{100} = \frac{1}{20}$

~~4~~
4+1=5

Probability of P complement

ii. $P(P') = \frac{76}{100}$

Probability of P complement

ii. $P(A \cap P \cap C) = \frac{1}{100}$