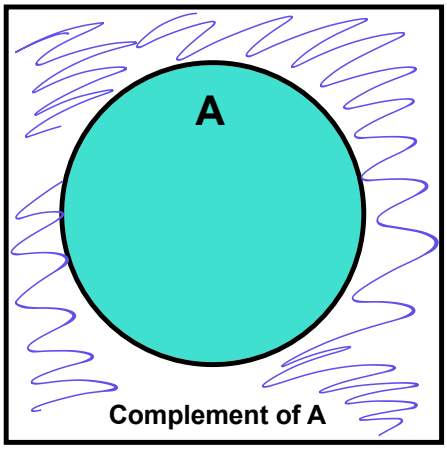
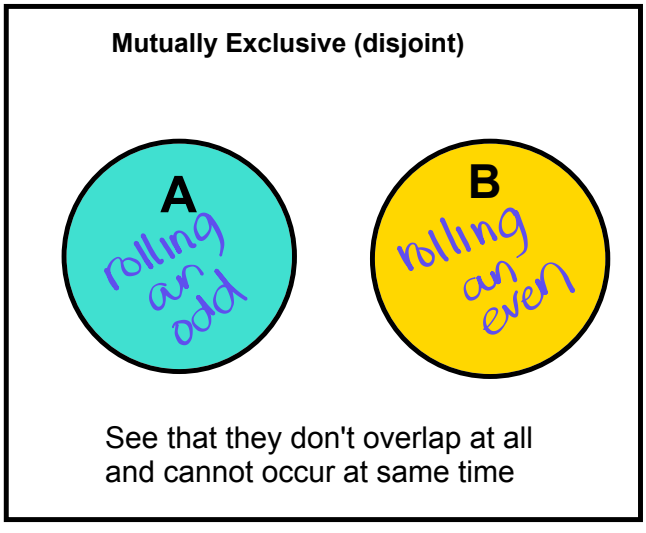
Venn Diagrams and Addition Rule
Day 6

LAST SECTION OF UNIT 8!!!!!!!!!!!!
WE MADE IT!!!!!!

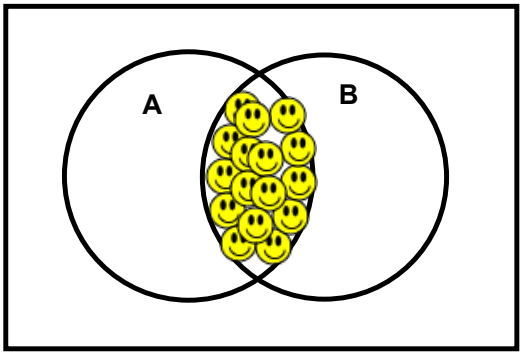


We sometimes called
the complement of A

A^C A' = everything BUT A



Visual difference of "and" and "or"

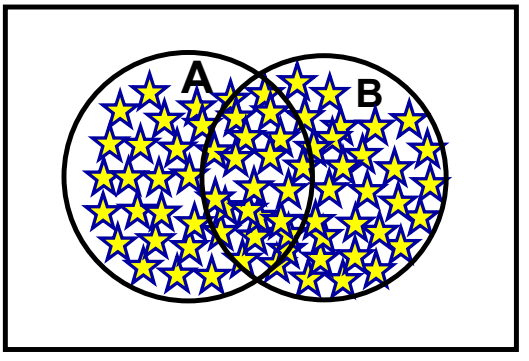


Event A and Event B

means both at same time

$A \cap B$ $\cap$ = and

Sometimes called the intersection



Event A or Event B

means one or the other (or both)

$A \cup B$ $\cup$ = or

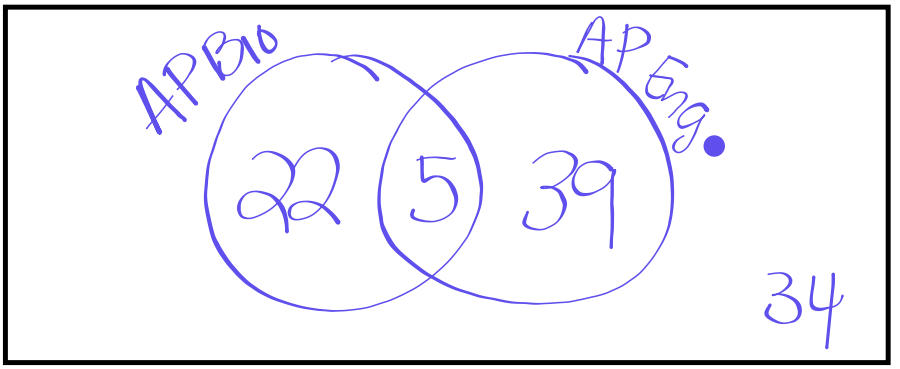
Sometimes called the union

Example 1: A survey of 100 seniors where they checked off if they were taking AP English or AP Biology

34 seniors are not in either AP English or AP Biology ✓
5 seniors are taking both AP English and AP Biology ✓
and 44 seniors are taking AP English

Always start at the intersection!

a) Create a Venn Diagram to represent the data, and fill in the counts for each region.



$100 - (5 + 39 + 34) = 22$

b) Fill in the chart below

Region in the Venn Diagram	In Words	In symbols	Count
In the intersection of two circles	Students who take AP Bio AND AP Eng●	$B \cap E$	5
Inside circle A, outside of circle B (AP Bio / AP Eng●)	Students who take AP Bio but NOT AP Eng●	$B \cap E'$	22
Inside circle B, outside of circle A (AP Eng● / AP Bio)	Students who take AP Eng● but NOT Bio	$B' \cap E$	39
Outside of both circles	Students who don't take either	$B' \cap E'$	34

c) How many students are taking AP English?

39+5=44 students

d) How many students are taking AP Biology?

22+5=27 students

e) How many students are taking AP Biology or AP English

22+5+39=66 students

f) How many students are taking AP Biology and AP English?

5 students

g) How many students are taking AP Biology but not AP English?

22 students

Why can't I just add the students taking AP English
and the students taking AP Biology to figure out

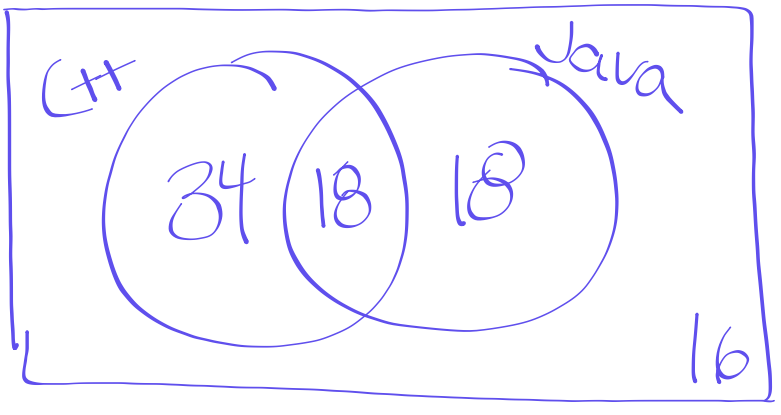
"How many students are taking AP English or AP Biology?"

b/c it overlaps & double counts the intersection of both events!

Example 2: In a computer science class, a professor surveyed the 86 students about which computer language they are proficient in writing programs (C++ or Java).

18 students were proficient with both languages
16 students were not proficient with either languages
and 52 were proficient with C++.

a) Create a Venn Diagram and answer the questions below.



b) How many students know Java?

18 + 18 = 36 students

c) How many students know C++?

34 + 18 = 52 students

d) How many students know Java or C++?

18 + 18 + 34 = 70 students

e) How many students know Java and C++?

18 students ← intersection

f) How many students know Java but not C++? J ∩ C++

18 students

g) What is the probability that a randomly selected student knows Java?

$P(\text{Java}) = 36/86 \approx .419$

h) What is the probability that a randomly selected student knows C++?

$P(\text{C++}) = 52/86 \approx .605$

i) What is the probability that a randomly selected student knows C++ or Java?

$P(\text{C++ OR J}) = \frac{70}{86} \approx .814$

Example 3:

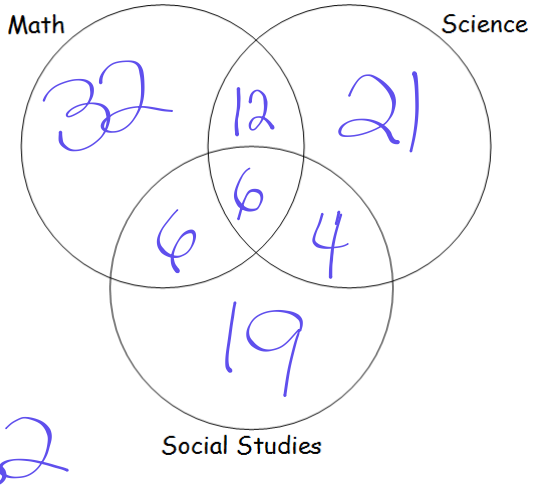
Use the following information to fill in the Venn Diagram below.

100 people were asked if they liked Math, Science, or Social Studies.
Everyone answered that they liked at least one.

56 like Math → 56 − (12 + 6 + 6) = 32
43 like Science → 43 − (12 + 6 + 4) = 21
35 like Social Studies → 35 − (6 + 6 + 4) = 19

18 like Math and Science → 18 − 6 = 12
10 like Science and Social Studies → 10 − 6 = 4
12 like Math and Social Studies → 12 − 6 = 6

6 like all three subjects ✓



1. How many people like Math only? 32

2. How many people like Science only? 21

3. How many people like Social Studies only? 19

From the examples using "or" we found we need to avoid a double-count.

Addition Rule of Probability

P(A or B) = P(A) + P(B) - P(A and B)

P (A ∪ B) = P(A) + P(B) - P(A ∩ B)

Same eq. just in words/symbols!

Example 4: Find the probability

A card is pulled from a standard deck.

a) P(Ace or Spade)

$P(Ace) + P(Spade) - P(A \cap S)$

$4/52 + 13/52 - 1/52$

$= 16/52 \approx .308$

b) P(Red or King)

$P(R) + P(K) - P(R \cap K)$

$\frac{26}{52} + \frac{4}{52} - 2/52$

$= 28/52 \approx .538$

c) P(Jack or Even Number)

$P(J) + P(Even) - P(J \cap Even)$

$\frac{4}{52} + \frac{20}{52} - 0/52 = \frac{24}{52} \approx .462$

A show is selected at random

Three cable channels (6, 8, and 10) have quiz shows, comedies, and dramas. The number of each is shown here.

Type of show	Channel 6	Channel 8	Channel 10	
Quiz show	5	2	1	8
Comedy	3	2	8	13
Drama	4	4	2	10
Total	12	8	11	31

a) P(Quiz show or on Channel 8)

$\frac{8}{31} + \frac{8}{31} - \frac{2}{31}$

$= 14/31$

b) P (Drama and Comedy)

$\frac{0}{31}$ P(Drama and Ch 10) $= 2/31$

c) P (on Channel 10 or drama)

$\frac{11}{31} + \frac{10}{31} - \frac{2}{31}$

$= 19/31$

Exit Ticket:

Rolling a 10 sided die

a) P (5 or greater than 6)

b) P(less than 6 or even)

c) P(10 or odd number)

Exit Ticket:

In a sales effectiveness seminar, a group of sales representatives tried two approaches to selling a customer a new automobile: the aggressive approach and the passive approach. For 1160 customers, the following record was kept:

	Sale	No Sale	Total
Aggressive	270	310	580
Passive	416	164	580
Total	686	474	1160

a) P(Sale or No Sale)

b) P(No sale and Aggressive)

c) P(Aggressive or Sale)

d) P(Passive and No Sale)

BRING TEXTBOOKS BACK!

HOMEWORK:

P. 161 #7-9, 17, 18, 21, 25

due Fri, 5/12