

Warm-up:



Vs.



Do you **ONLY** cats? 5

ONLY **ONLY** dogs? 8

ONLY **BOTH** cats and dogs? 3

NEITHER cats or dogs? 1

BOTH cats and dogs? 3

NEITHER cats or dogs? 1

Class Plan

1) Warm-up

2) Venn Diagrams

-Creating Venn diagrams

-Shading Venn diagrams

-Using set and probability notation

Chapter 3 and 14


A | SETS

E | VENN DIAGRAMS

3) Practice

AP Human Geography Exam:

7:45 am

Room Number	Testers by Last Names
306	Abdi – Arent
307	Arnold – Bteibet
308	Camara - Courbois
309	Crow - Gilbertson
310	Gingrich - Johnson 
311	Justin - Lindgren
315	Loftus – Ortega
317	Pankratz – Schoenëcker
W301	Schulte – Sverdin
W302	Swenson – Zahn

Not taking AP Exam?

Report to Mr. Kohnert (E102) for core classes during hours 1, 2, 3, and/or 4

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

Advisory schedule:

ADVISORY BELL SCHEDULE (w/3 lunches)

Lunch A			Lunch B			Lunch C		
1st Hour	8:05-8:48	43 minutes	1st Hour	8:05-8:48	43 minutes	1st Hour	8:05-8:48	43 minutes
2nd Hour	8:53-9:36	43 minutes	2nd Hour	8:53-9:36	43 minutes	2nd Hour	8:53-9:36	43 minutes
Advisory	9:41-10:25	44 minutes	Advisory	9:41-10:25	44 minutes	Advisory	9:41-10:25	44 minutes
3rd Hour	10:30-11:13	43 minutes	3rd Hour	10:30-11:13	43 minutes	3rd Hour	10:30-11:13	43 minutes
Lunch A	11:18-11:48	30 minutes	4th Hour (Early)	11:18-12:01	43 minutes	4th Hour (Early)	11:18-12:01	43 minutes
4th Hour (Late)	11:53-12:36	43 minutes	Lunch B	12:06-12:36	30 minutes	5th Hour (Early)	12:06-12:49	43 minutes
5th Hour (Late)	12:41-1:24	43 minutes	5th Hour (Late)	12:41-1:24	43 minutes	Lunch C	12:54-1:24	30 minutes
6th Hour	1:29-2:12	43 minutes	6th Hour	1:29-2:12	43 minutes	6th Hour	1:29-2:12	43 minutes
7th Hour	2:17-3:00	43 minutes	7th Hour	2:17-3:00	43 minutes	7th Hour	2:17-3:00	43 minutes

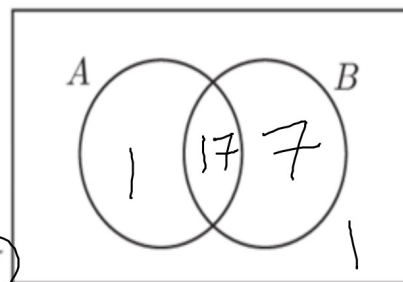
Create Our Own Venn Diagram

EXAMPLE 1: Cats & Dogs

1st hour

Cats (A) and Dogs (B)

What do you like?	Number of Students
ONLY cats	1
ONLY dogs	7
BOTH cats and dogs	17
Neither cats or dogs	1



$26 = U$

ONLY cats? 1

ONLY dogs? 7

BOTH cats and dogs? 17

NEITHER cats or dogs? 1

1st hour

2. Let's look at how many students like...

a) Cats? **Set A** = 18

b) Dogs? **Set B** = 24

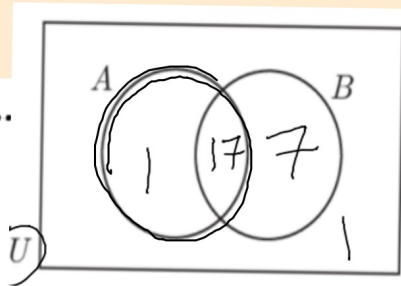
c) EITHER Cats or Dogs? $A \cup B =$ 25 (All circles)

d) BOTH cats and dogs $A \cap B =$ 17

d) ONLY Cats $A - (A \cap B) =$ 1

e) ONLY Dogs $B - (A \cap B) =$ 7

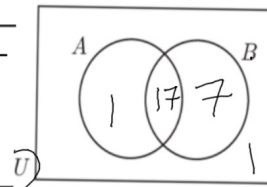
f) Neither cats or dogs $(A \cup B)^c =$ 1



1st hour

3. What can you conclude from our Venn diagram?

Most of 1st likes cats or dogs.



Think: What is the probability that a randomly selected student from your class period does not like cats?

$$P(\text{not cats}) = P(A') = \frac{8}{26} = \frac{4}{13}$$

What notation could be used to show this probability?

Create Our Own Venn Diagram

EXAMPLE 1: Cats & Dogs

2nd hour

U: Universe Cats (A) and Dogs (B)
wholeclass

What do you like?	Number of Students
ONLY cats	3
ONLY dogs	4
BOTH cats and dogs	11
Neither cats or dogs	1



U
= 19

ONLY cats? 3

ONLY dogs? 4

BOTH cats and dogs? 11

NEITHER cats or dogs? 1

2nd hour

2. Let's look at how many students like...

a) Cats? **Set A** = 14

b) Dogs? **Set B** = 15

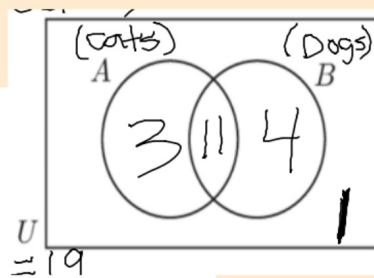
c) EITHER Cats or Dogs? $A \cup B =$ 18 $= 3 + 11 + 4$

d) BOTH cats and dogs $A \cap B =$ 11

d) ONLY Cats $A - (A \cap B) =$ 3

e) ONLY Dogs $B - (A \cap B) =$ 4

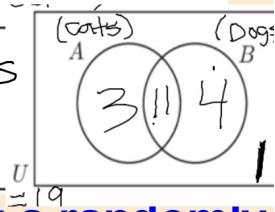
f) Neither cats or dogs $(A \cup B)' =$ 1



2nd hour

3. What can you conclude from our Venn diagram?

More students like cats & dogs than any other group.



Think: What is the probability that a randomly selected student from your class period does not like cats?

$$P(\text{not } A) = P(A') = \frac{5}{19}$$

What notation could be used to show this probability?

Create Our Own Venn Diagram

EXAMPLE 1: Cats & Dogs

4th hour

U: Universe
(Sample space)
Cats (A) and Dogs (B)

What do you like?	Number of Students
ONLY cats	2
ONLY dogs	9
BOTH cats and dogs	9
Neither cats or dogs	1



U
= 21

ONLY cats? 2

ONLY dogs? 9

BOTH cats and dogs? 9

NEITHER cats or dogs? 1

4th hour

2. Let's look at how many students like...

a) Cats? Set A = 11

b) Dogs? Set B = 18

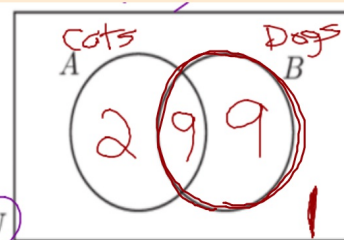
c) EITHER Cats or Dogs? $A \cup B = \underline{20}$

d) BOTH cats and dogs $A \cap B = \underline{9}$

d) ONLY Cats $A - (A \cap B) = \underline{2}$

e) ONLY Dogs $B - (A \cap B) = \underline{9}$

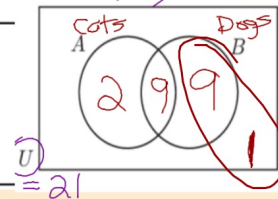
f) Neither cats or dogs $(A \cup B)^c = \underline{1}$



4th hour

3. What can you conclude from our Venn diagram?

More students like dogs
than cats



Think: What is the probability that a randomly selected student from your class period does not like cats?

$$P(\text{not cat}) = P(A') = \frac{10}{21}$$

What notation could be used to show this probability?

Create Our Own Venn Diagram

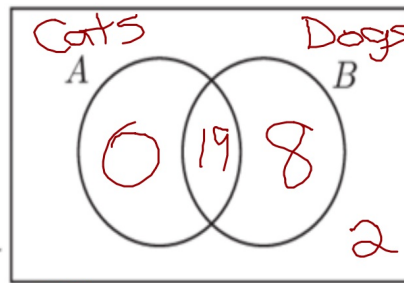
EXAMPLE 1: Cats & Dogs

5th hour

U: Universe

Cats (A) and Dogs (B)

What do you like?	Number of Students
ONLY cats	0
ONLY dogs	8
BOTH cats and dogs	19
Neither cats or dogs	2



U
= 29

ONLY cats? 0

ONLY dogs? 8

BOTH cats and dogs? 19

NEITHER cats or dogs? 2

5th hour

2. Let's look at how many students like...

a) Cats? Set A = 19

b) Dogs? Set B = 27

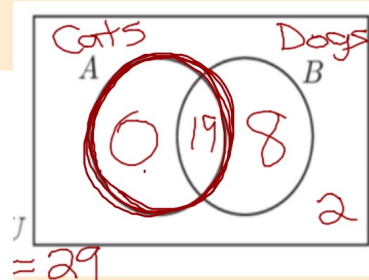
c) EITHER Cats or Dogs? $A \cup B =$ 27

d) BOTH cats and dogs $A \cap B =$ 19

d) ONLY Cats $A - (A \cap B) =$ 0

e) ONLY Dogs $B - (A \cap B) =$ 8

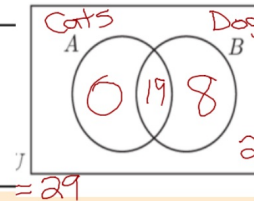
f) Neither cats or dogs $(A \cup B)' =$ 2



5th hour

3. What can you conclude from our Venn diagram?

Most of 5th hour like both cats & dogs.



Think: What is the probability that a randomly selected student from your class period does not like cats?

$$P(A^c) = \frac{10}{29}$$

What notation could be used to show this probability?

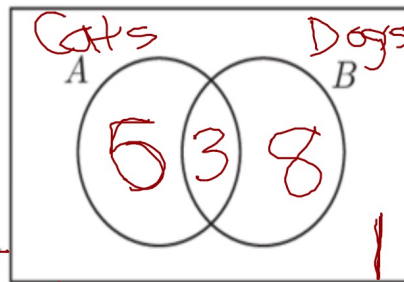
Create Our Own Venn Diagram

EXAMPLE 1: Cats & Dogs

7th hour

U = Universe Cats (A) and Dogs (B)

What do you like?	Number of Students
ONLY cats	5
ONLY dogs	8
BOTH cats and dogs	3
Neither cats or dogs	1



U
= 18

ONLY cats? 5

ONLY dogs? 8

BOTH cats and dogs? 3

NEITHER cats or dogs? 1

7th hour

2. Let's look at how many students like...

a) Cats? Set A = 9

b) Dogs? Set B = 11

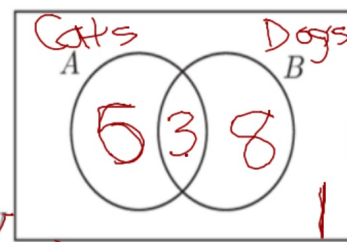
c) EITHER Cats or Dogs? $A \cup B =$ 17 = 6 + 3 + 8

d) BOTH cats and dogs $A \cap B =$ 3

d) ONLY Cats $A - (A \cap B) =$ 6

e) ONLY Dogs $B - (A \cap B) =$ 8

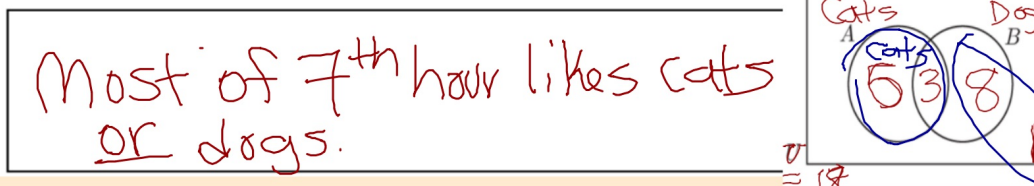
f) Neither cats or dogs $(A \cup B)' =$ 1



\cup
 $= 17$

7th hour

3. What can you conclude from our Venn diagram?



Think: What is the probability that a randomly selected student from your class period does not like cats?

$$P(A') = \frac{9}{18} = \frac{1}{2}$$

What notation could be used to show this probability?

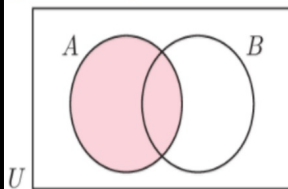
Notes: Set Notation (backside of handout)

Interpret each region using cats and dogs.

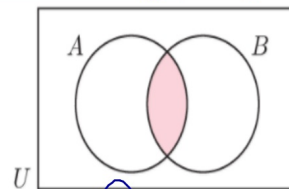
Set A: Students who like cats U : All students

Set B: Students who like dogs in your hour

Students who like cats.



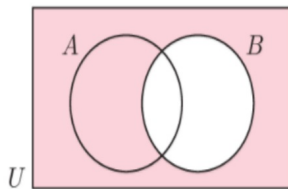
A is shaded



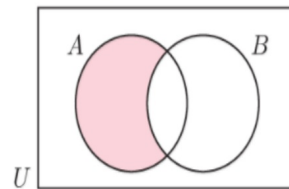
$A \cap B$ is shaded

Students who like both cats and dogs.

Students who **do not** like dogs.



B' is shaded



$A \cap B'$ is shaded

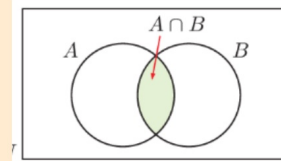
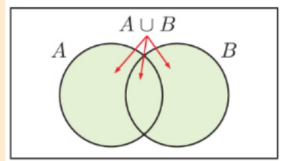
Students who only like cats.

Just cats

Notes: Venn Diagram Notation

B' : Complement of B (NOT in B)	$A \cup B$: Union (EITHER OR)	$A \cap B$: Intersection (AND)
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$\rightarrow A$



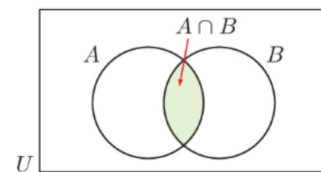
UNION AND INTERSECTION

If P and Q are two sets then:

- $P \cap Q$ is the **intersection** of P and Q , and consists of all elements which are in **both** P and Q .
- $P \cup Q$ is the **union** of P and Q , and consists of all elements which are in either P or Q (or both).

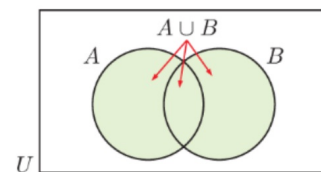
The **intersection** of two sets A and B consists of all elements common to both A and B .

$A \cap B$ is the shaded region where the circles representing A and B overlap.



The **union** of two sets A and B consists of all elements in A or B or both.

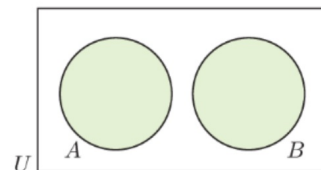
$A \cup B$ is the shaded region which includes everywhere in either circle.



Could this have happened with our example?
Yes! If no students liked both animals!

Disjoint or **mutually exclusive** sets do not have common elements.

They are represented by non-overlapping circles.



UNION AND INTERSECTION

If P and Q are two sets then:

- $P \cap Q$ is the **intersection** of P and Q , and consists of all elements which are in **both P and Q** .
- $P \cup Q$ is the **union** of P and Q , and consists of all elements which are in either P **or** Q (or both).

Example 5

On separate Venn diagrams, shade these regions for two intersecting sets A and B:

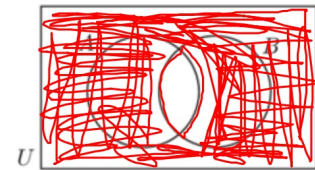
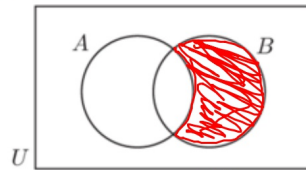
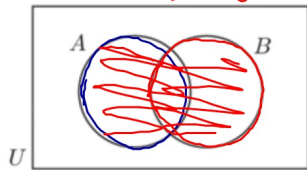
a $A \cup B$ Union
A or B (Circles)

b $A' \cap B$

Not A and in B Not in both

c $(A \cap B)'$

not A and B



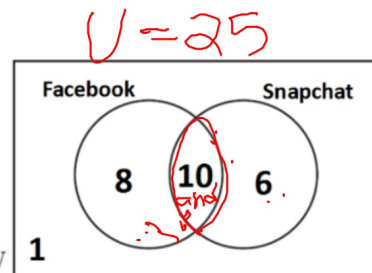
Only B



Example 3: Facebook and Snapchat

Find the number of students that like each social media application, and translate what it means in the context of the problem.

1. $F = 18$ Like Facebook
2. $S = 16$ Like Snap
3. $F \cup S = 24$ F OR Snap (or both)
4. $F \cap S = 10$ F and Snap
5. $F' = 7$ Not F
6. $(F \cap S)' = 15$ Not in both F and snap



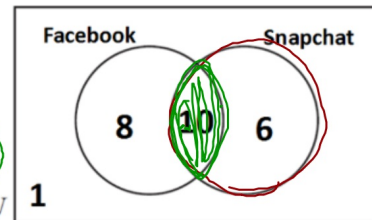
7. Probability Question: Of the students who like Snapchat, what is the probability that they do not like Facebook?

$$P(S) = \frac{16}{25} \quad \frac{P(F' \cap S)}{P(S)} = \frac{6}{16}$$

Example 3: Facebook and Snapchat

Find the number of students that like each social media application, and translate what it means in the context of the problem.

1. $F = 18$ (Facebook users)
2. $S = 16$ (Snapchat users)
3. $F \cup S = 24$ (Facebook OR Snapchat)
4. $F \cap S = 10$ (Facebook AND Snapchat)
5. $F' = 7$ (Not a Facebook user)
6. $(F \cap S)' = 15$ (Not on both Facebook and Snapchat)



7. Probability Question: Of the students who like Snapchat, what is the probability that they do not like Facebook?

$$\frac{P(S \cap F')}{P(S)} = \frac{6}{16} = \frac{3}{8}$$

"only SNAP"

Exercises...

3E.1 and 3E.2 Venn Diagrams
(Handout is **a couple** problems)

Challenge: 3E.2 #5 and #6

$$a) \{1, 4, 5, 7\}$$

$$Q = \{2, 5, 7\}$$

$$(P \cap Q)$$

EXERCISE 3E.1

1 For the Venn diagram alongside, list the elements of:

a P

b Q

c $P' = 2, 3, 6$

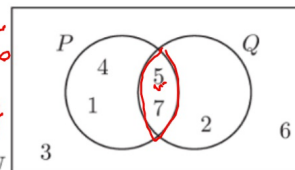
d Q'

e $P \cap Q = 5, 7$

f $P \cup Q$

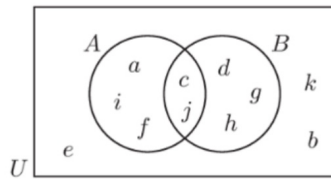
g U

$$= \{1, 2, 4, 5, 7\}$$



Exercises... 3E Venn Diagrams

2



Consider the Venn diagram shown.

List the elements of the set:

a A

b B

c A'

d B'

e $A \cap B$

f $A \cup B$

Exercise Solutions

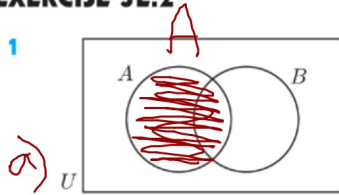
EXERCISE 3E.1

- 1** **a** {1, 4, 5, 7} **b** {2, 5, 7} **c** {2, 3, 6} **d** {1, 3, 4, 6}
e {5, 7} **f** {1, 2, 4, 5, 7} **g** {1, 2, 3, 4, 5, 6, 7}
- 2** **a** {a, c, f, i, j} **b** {c, d, g, h, j} **c** {b, d, e, g, h, k}
d {a, b, e, f, i, k} **e** {c, j} **f** {a, c, d, f, g, h, i, j}

Exercises... 3E Venn Diagrams

EXERCISE 3E.2

1



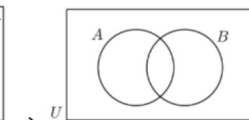
On separate Venn diagrams, shade the region:

- a in A
- b not in A
- c in neither A nor B
- d in A and B
- e in either A or B , but not both.



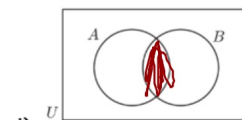
b)

A'



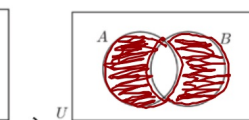
c)

$(A \cup B)$



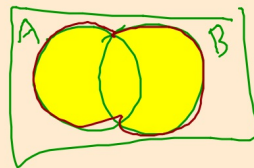
d)

$A \cap B$



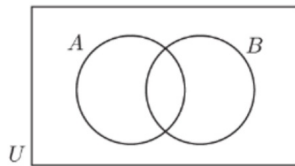
e)

$(A \cup B) \cap (A \cap B)'$



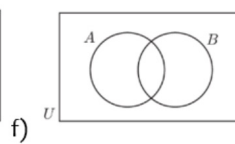
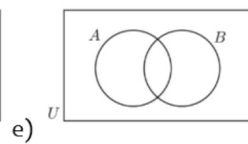
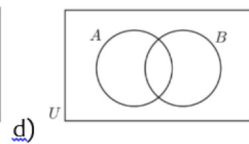
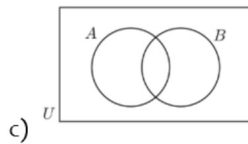
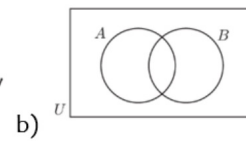
Exercises... 3E Venn Diagrams

2



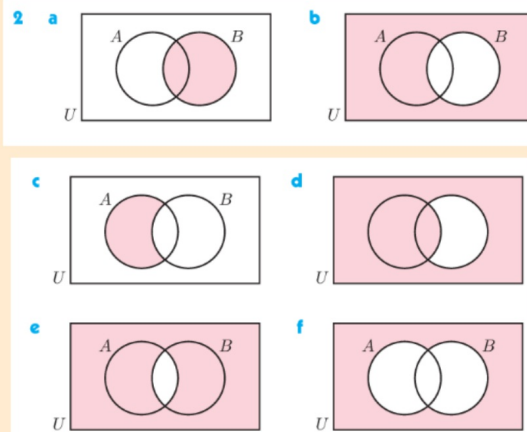
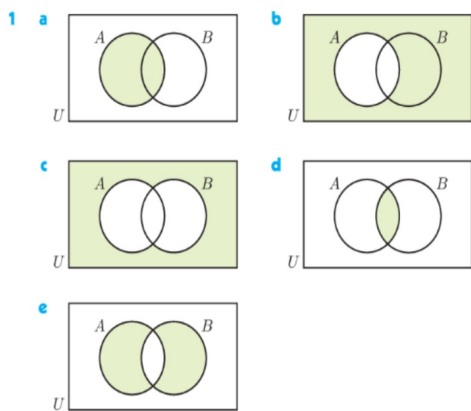
On separate Venn diagrams, shade:

- a B
- b B'
- c $A \cap B'$
- d $A \cup B'$
- e $(A \cap B)'$
- f $(A \cup B)'$



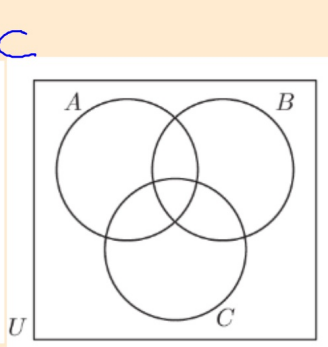
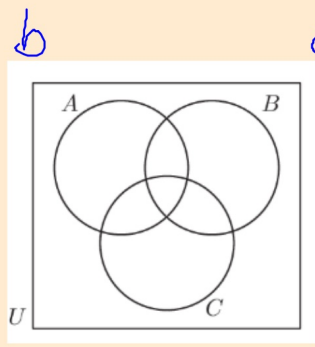
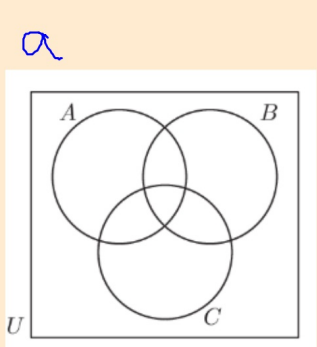
Exercise Solutions

EXERCISE 3E.2



Challenge: 5 On separate Venn diagrams, shade:

- | | | |
|-----------------------------|------------------------|-------------------------------|
| a A | b B | c C' |
| d $A \cup B$ | e $B \cap C$ | f $A \cap B \cap C$ |
| g $A \cap B' \cap C$ | h $(A \cup B)'$ | i $A' \cup (B \cap C)$ |



Exercises:

5 On separate Venn diagrams, shade:

a A

b B

c C'

d $A \cup B$

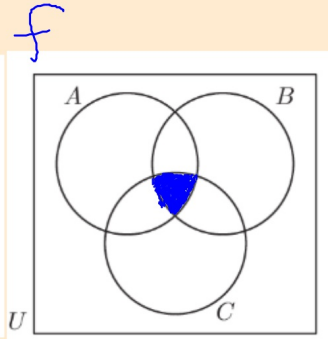
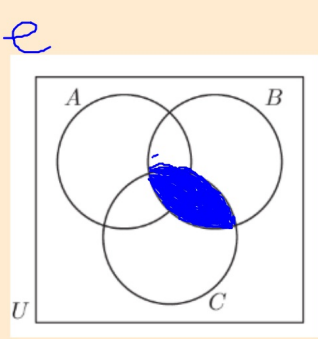
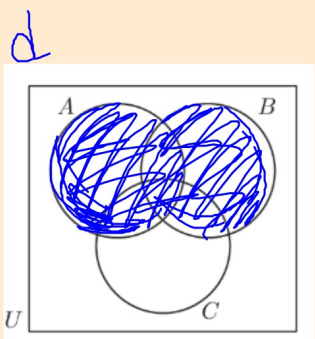
e $B \cap C$

f $A \cap B \cap C$

g $A \cap B' \cap C$

h $(A \cup B)'$

i $A' \cup (B \cap C)$



Exercises:

5 On separate Venn diagrams, shade:

a A

b B

c C'

d $A \cup B$

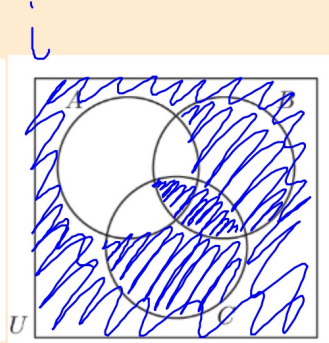
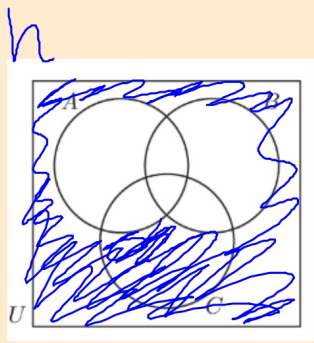
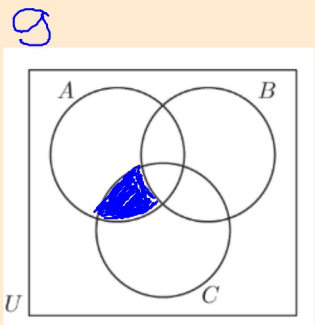
e $B \cap C$

f $A \cap B \cap C$

g $A \cap B' \cap C$

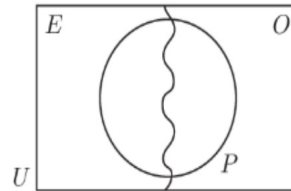
h $(A \cup B)'$

i $A' \cup (B \cap C)$



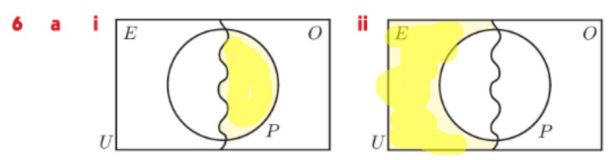
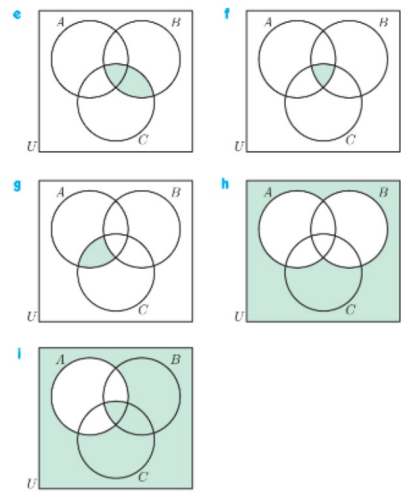
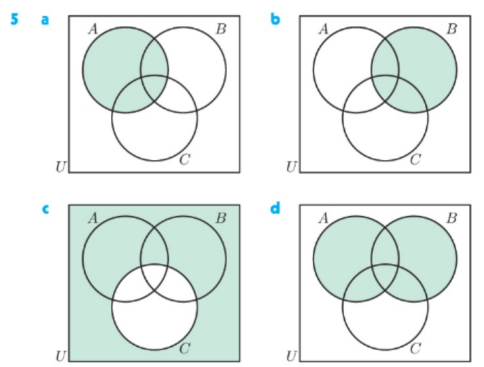
Exercises:

- 6 In the Venn diagram shown, $U = \mathbb{Z}^+$,
 $E = \{\text{positive even integers}\}$,
 $O = \{\text{positive odd integers}\}$, and
 $P = \{\text{prime numbers}\}$.



- a** On separate Venn diagrams, shade the region which represents the set of:
- i** odd prime numbers
 - ii** even composite numbers.
- b** Explain what the region $E \cap P$ represents. Hence write down $n(E \cap P)$.

Exercise Solutions



b even prime numbers, $n(E \cap P) = 1$