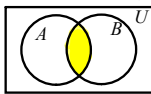# 2.3 Completed Notes

<u>2.3: Other Set Operations</u>

Definition: If A and B are sets, the <u>intersection of A and B</u>, denoted $A \cap B$, is the set of elements that are in **both** A **and** B. That is,
$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$.

An intersection can be thought of in the following manner. The shaded region is $A \cap B$:
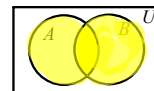
Examples:
$\{1, 2, 3, 4\} \cap \{2, 4, 6, 8\} = \{2, 4\}$
$\{x^2 \mid x \in \mathbb{Z}\} \cap \{1, 2, ..., 20\} = \{1, 4, 9, 16\}$
$\{0, 1, 4, 9, 16, 25, ...\}$
$\{1, 2\} \cap \{1, 2, 3\} = \{1, 2\}$
$\{1, 2\} \cap \{3, 4\} = \emptyset \ \{ \}$
$\emptyset \cap \{1, 2\} = \emptyset \ \{ \}$

Definition: If A and B are sets, the <u>union of A and B</u>, denoted $A \cup B$, is the set of elements that are in **either** A **or** B. That is,
$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$.

A union can be thought of in the following manner. The shaded region is $A \cup B$:

Examples:
$\{1, 2, 3, 4\} \cup \{2, 4, 6, 8\} = \{1, 2, 3, 4, 6, 8\}$
$\{x^2 \mid x \in \mathbb{Z}\} \cup \{1, 2, ..., 20\} = \{0, 1, 2, 3, 4, ..., 20, 25, 36, 49, ...\}$
$\{0, 1, 4, 9, 16, 25, 36, ...\}$
$\{1, 2\} \cup \{1, 2, 3\} = \{1, 2, 3\}$
$\{1, 2\} \cup \{3, 4\} = \{1, 2, 3, 4\}$
$\emptyset \cup \{1, 2\} = \{1, 2\}$

Definition: If A and B are sets, the <u>set difference of B and A</u> (or <u>relative complement of A relative to B</u>), denoted $A - B$ and read "A set minus B", is the set of elements that are in A but not in B. That is,
$A - B = \{x \mid x \in A \text{ and } x \notin B\}$.

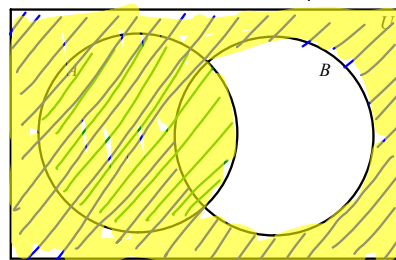A set difference can be thought of in the following manner. The shaded region is $A - B$:
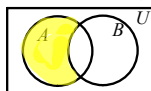
Examples:
$\{1, 2, 3, 4\} - \{2, 4, 6, 8\} = \{1, 3\}$
$\{1, 2, ..., 20\} - \{x^2 \mid x \in \mathbb{Z}\} = \{2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20\}$
$\{0, 1, 4, 9, 16, 25, ...\}$
$- \{1, 2, 3\} = \emptyset$
$\{1, 2\} - \{3, 4\} = \{1, 2\}$
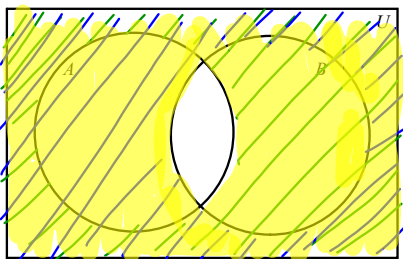$\emptyset - \{1, 2\} = \emptyset$

Example: Draw the Venn Diagram for $\overline{A \cup B}$.
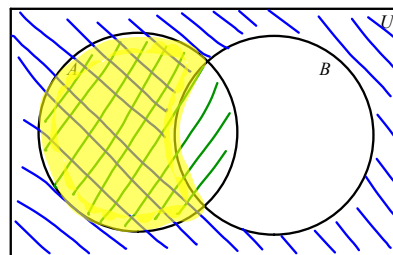
Union: Draw same direction, and highlight

everything shaded.

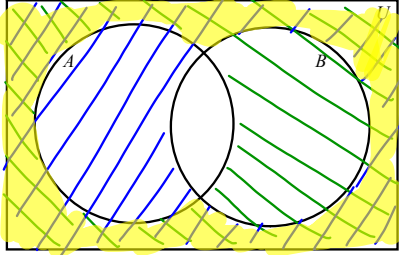Example: Draw the Venn Diagram for $\overline{A} \cup \overline{B}$.

Example: Draw the Venn Diagram for $\overline{A} \cap \overline{B}$.

2.3 Completed Notes

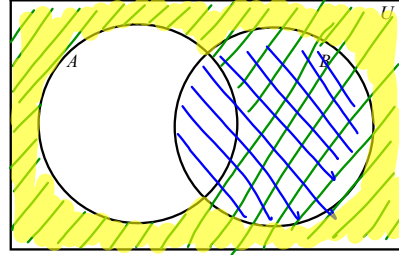Example: Draw the Venn Diagram for $\overline{A} \cap \overline{B}$.

Intersection: Shade opposite ways. Highlight where

the lines intersect.

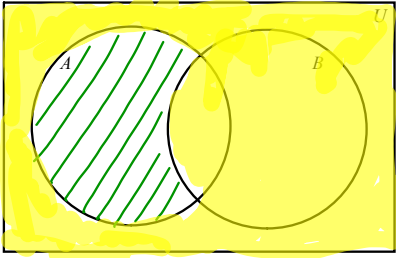Example: Draw the Venn Diagram for $\overline{A} - \overline{B}$.

Set Minus: Shade opposite ways. Highlight what

was shaded for _only_ the first set.

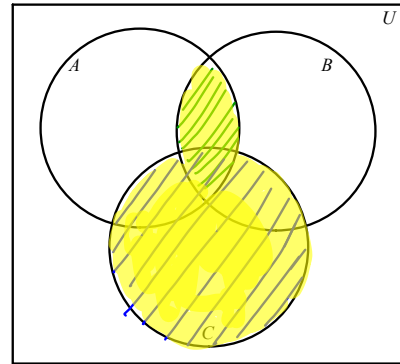Example: Draw the Venn Diagram for $\overline{A - B}$.

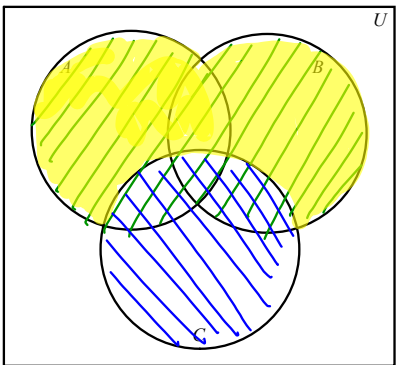Complement over whole thing: Shade what's
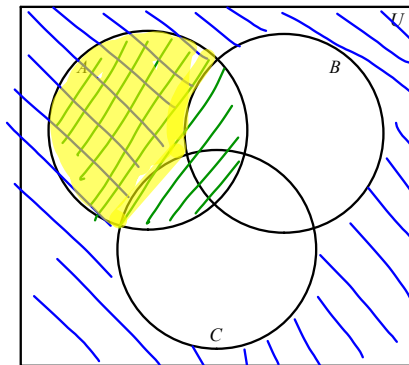
underneath, then highlight everything _not_ shaded

Example: Draw the Venn Diagram for $(A \cap B) \cup C$.
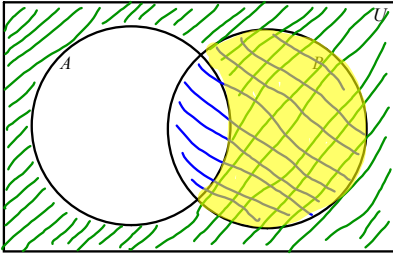
Example: Draw the Venn Diagram for $(A \cup B) - C$.
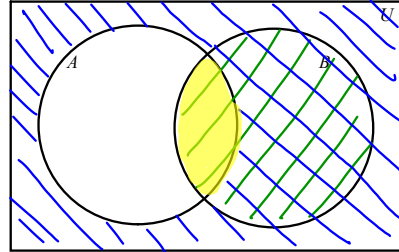
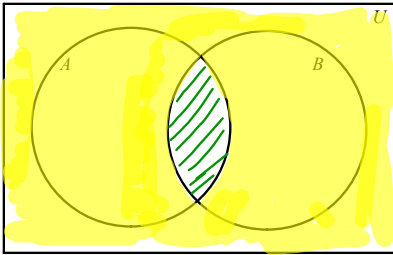Example: Draw the Venn Diagram for $A \cap (B \cup C)$.

2.3 Completed Notes

Problem 1: Draw the Venn Diagram for $A \cap \overline{B}$
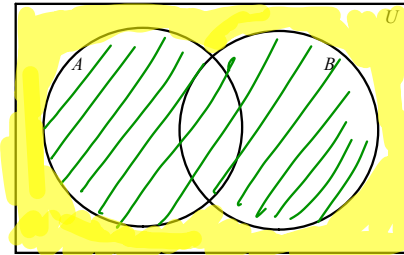
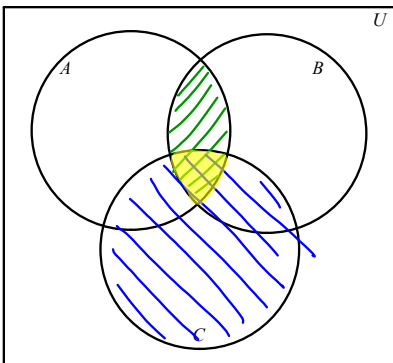Problem 2: Draw the Venn Diagram for $B - \overline{A}$

Problem 3: Draw the Venn Diagram for $\overline{A \cap B} = \overline{A} \cup \overline{B}$

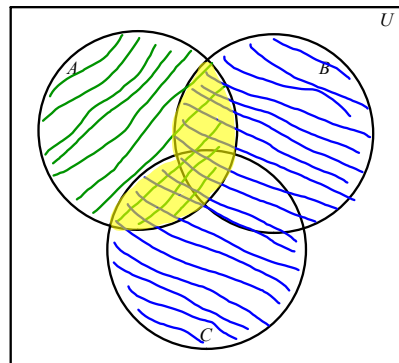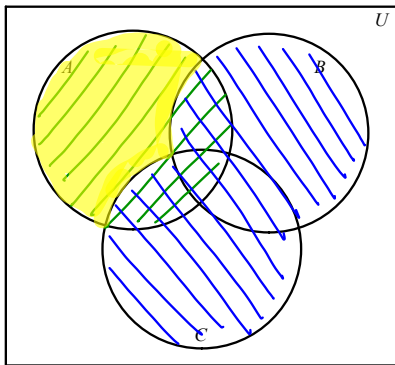Problem 4: Draw the Venn Diagram for $\overline{A \cup B}$.

Problem 5: Draw the Venn Diagram for $(A \cap B) \cap C$.

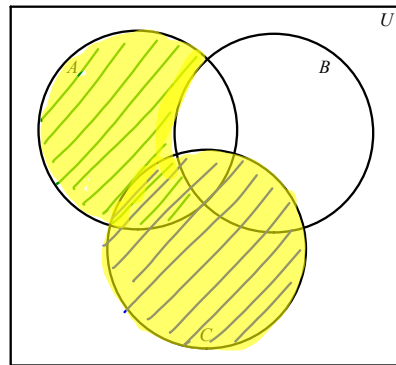Problem 6: Draw the Venn Diagram for $A \cap (B \cup C)$
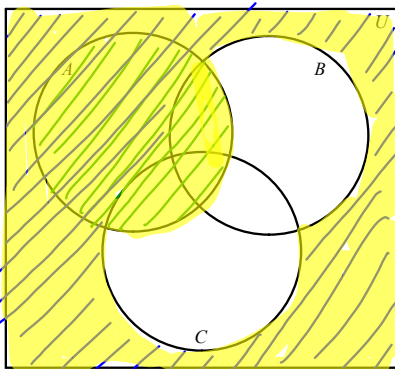
2.3 Completed Notes

Problem 7: Draw the Venn Diagram for $A - (B \cup C)$

Problem 8: Draw the Venn Diagram for $(A - B) \cup C$

Problem 9: Draw the Venn Diagram for $A \cup (B \cup C)$

Problem 10: Draw the Venn Diagram for $A \cap (B \cap C)$
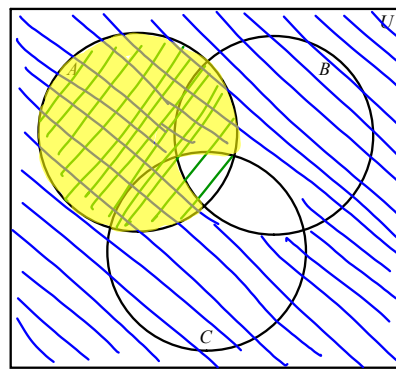
You have an average of 70 on 5 quizzes, and you may drop your lowest quiz grade of 50. What is your new average?

$$70 = \frac{q_1 + q_2 + q_3 + q_4 + 50}{5}$$

$350 = q_1 + q_2 + q_3 + q_4 + 50 \quad (70 \times 5 = 350)$

$300 = q_1 + q_2 + q_3 + q_4$

New average: $\frac{300}{4} = 75$

$(\underbrace{4n+1}_{\text{last page number}})\underbrace{2 \times n}$

sum of one side, two sides of a sheet

n sheets

Problem Solving #1

$2n(4n+1)$

$S = \frac{n(n+1)}{2}$

#2

2.3 Completed Notes

Find the sum

$$1 + 4 + 7 + 10 + 13 + 16 + 19 + 22 + 25 = S$$
$$25 + 22 + 19 + 16 + 13 + 10 + 7 + 4 + 1 = S$$
$$\overline{26 + 26 + 26 + 26 + 26 + 26 + 26 + 26 + 26 = 2S}$$

$$2S = 9 \times 26 = 234$$
$$S = \frac{234}{2} = \boxed{117}$$

Andrew, Danny, Heather, and Michael went to an undisclosed location to conduct the secret business of deciding what to eat for lunch the next day. They arrived at 9:55 PM, 10:00 PM, 10:10 PM, and 10:15 PM. Using the clues below, determine who arrived at each time.

— Danny thought he was being followed, so he circled around the block several times and ended up arriving at 10:10 PM.

— Heather arrived 15 minutes before Michael.

	9:55	10:00	10:10	10:15
A	O	X	X	X
D	X	X	O	X
H	X	O	X	X
M	X	X	X	O

Andrew: 9:55, Danny: 10:10,
Heather: 10:00, Michael: 10:15