

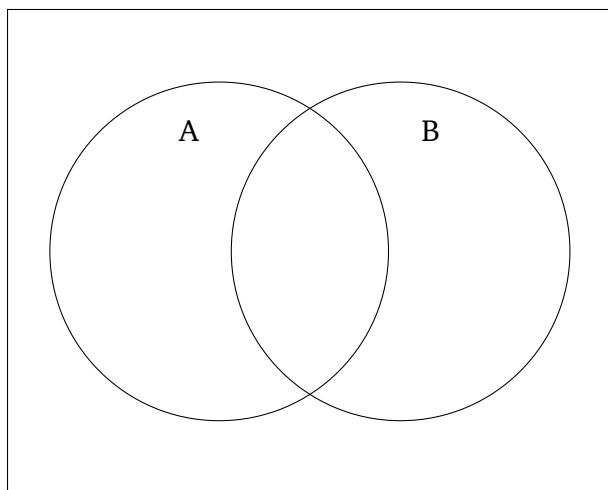
SET OPERATIONS HOMEWORK

TEXT: 1.3, 1.4, 1.5

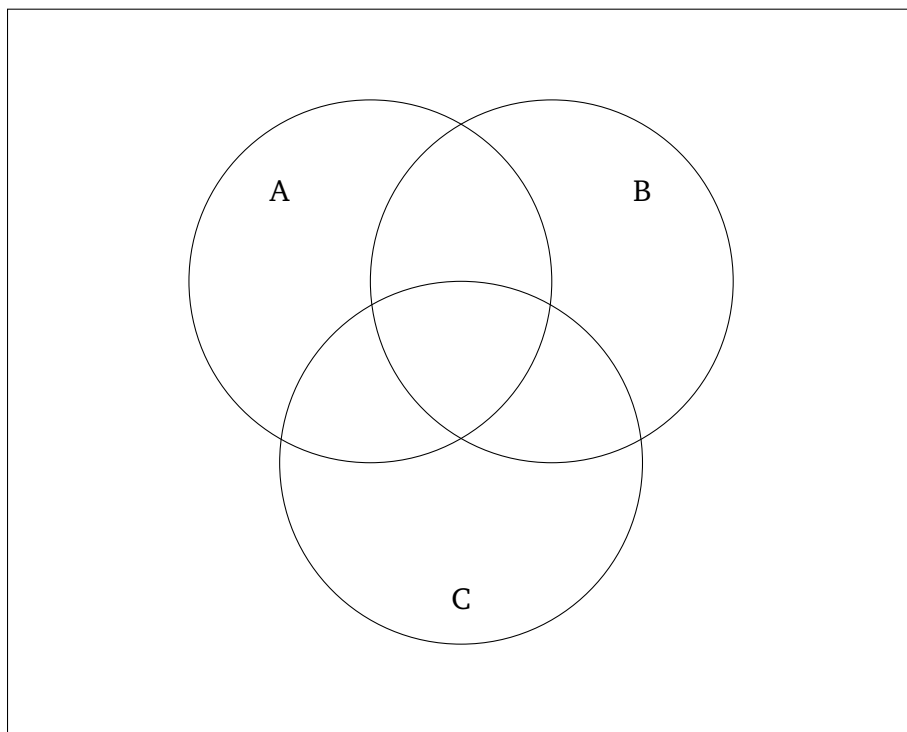
LAST NAME	FIRST NAME	DATE
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Fill out each Venn diagram with elements placed into the appropriate areas. Each element should appear in your answer exactly once.

1. $U = \{1, 2, 3, 4, 5, 6, 7\}$, $A = \{2, 3, 4\}$, $B = \{3, 5, 6, 7\}$



2. $U = \{d, e, f, g, h, i, j, k\}$, $A = \{d, e, h, i, k\}$, $B = \{e, f, g, h, i\}$, $C = \{h, i, k\}$



Let U be the universal set, and let the other sets be as follows:

$$U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{1, 2, 3, 4, 5\}$$

$$B = \{1, 3, 5\}$$

$$C = \{4, 6\}$$

Find the following sets and state them using the roster notation.

3. $A \cup B$

4. $A \cup C$

5. $A \cap C$

6. $B \cap C$

7. A'

8. B'

Let $D = \{d, o, g, s\}$, $E = \{c, o, i, n, s\}$, and $F = \{d, o, c, k\}$. The universal set is the set of all English letters. Find the following sets and state them using the roster notation.

9. $E - D$

10. $D - F$

11. $(D \cap E) \cup F$

12. $D \cap (E \cup F)$

13. $D - (F \cap E)$

14. $F - (D \cup E)$

Draw the generic Venn diagrams showing sets A , B , C , with the following sets shaded.

15. $(B \cap A) \cup C$

17. $(B' \cap A') \cap C$

16. $(C \cup A)' \cap B$

18. $(A \cup C) \cup B$

Recall that given a set X , we write $\mathcal{P}(X)$ for the set of all subsets of X , or *power set* operation, for short. State the following sets using the roster notation.

19. $\mathcal{P}(\{a\})$

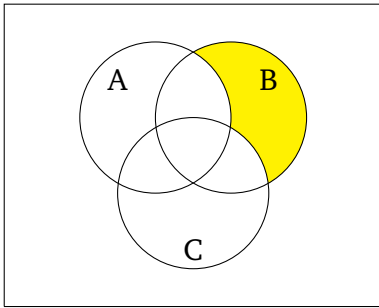
20. $\mathcal{P}(\{1, 2\})$

21. $\mathcal{P}(\emptyset)$

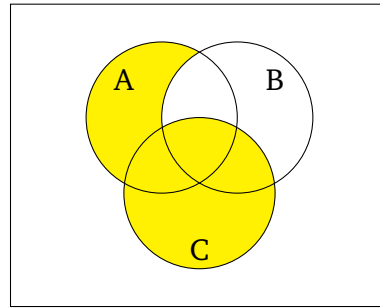
22. $\mathcal{P}(\{w, x, y, z\})$

Write an expression for the shaded region (many different correct answers are possible).

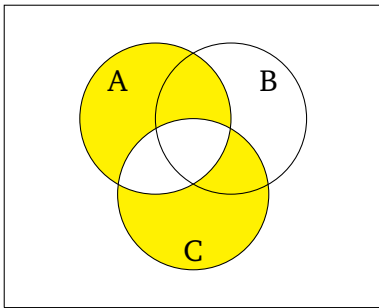
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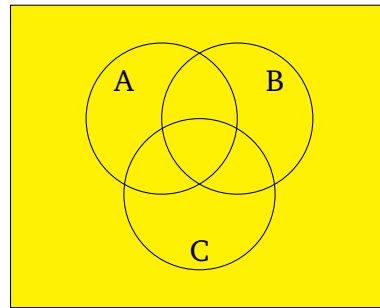
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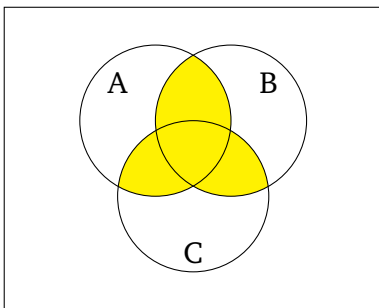
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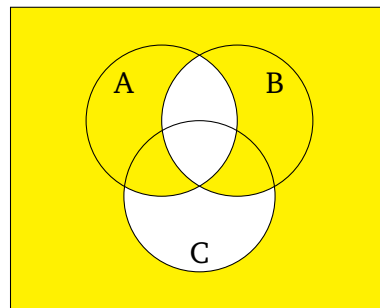
27.



25.



28.



Prove that the following laws hold for all sets by constructing a Venn diagram for each side of the given identities.

29. De Morgan's laws:

$$(P \cup Q)' = P' \cap Q'$$

$$(P \cap Q)' = P' \cup Q'$$

30. Distributivity laws:

$$(P \cup Q) \cap R = (P \cap R) \cup (Q \cap R)$$

$$(P \cap Q) \cup R = (P \cup R) \cap (Q \cup R)$$

31. Draw a diagram with a rectangle representing the universe of points within, and shapes inside the rectangle representing nonempty sets A , B , and C such that

- $A \cap B \neq \emptyset$
- $B \cap C \neq \emptyset$
- $A \cap C = \emptyset$

32. Draw a diagram with a rectangle representing the universe of points within, and shapes inside the rectangle representing nonempty sets W , X , Y , and Z such that

- $Y \subset W \cap X$
- $Z \subset (W \cup X)'$

33. Draw a diagram with a rectangle representing the universe of points within, and shapes inside the rectangle representing nonempty sets K , L and M such that

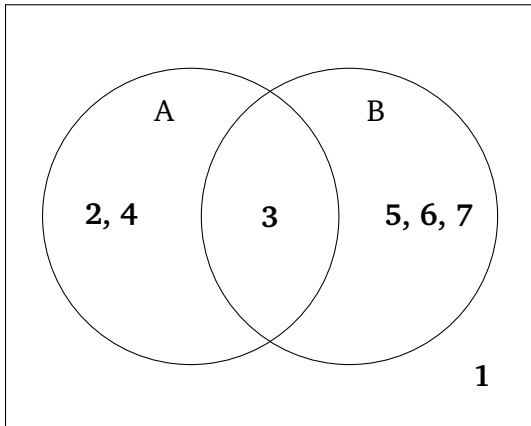
- $K \subset L$
- $M \cap K \neq \emptyset$
- $M \cap L' \neq \emptyset$
- $M \cap (L - K) = \emptyset$

34. Draw a Venn diagram for four sets. To make it a true Venn diagram, it needs to have every possible intersection of these four sets represented by some shape/area. For an additional challenge, try to make it symmetric. Finally, shade the set representing

$$(A - B) \cup (B - C) \cup (C - D) \cup (D - A)$$

ANSWERS

1.



3. $\{1, 2, 3, 4, 5\}$

5. $\{4\}$

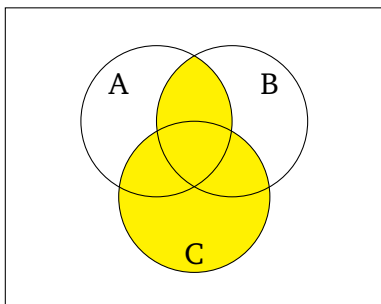
7. $\{0, 6, 7, 8, 9, 10\}$

9. $\{c, i, n\}$

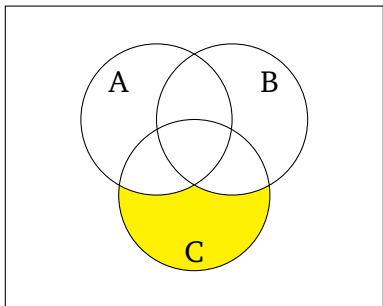
11. $\{d, o, c, k, s\}$

13. $\{d, g, s\}$

15.



17.



19. $\{\emptyset, \{a\}\}$

21. $\{\emptyset\}$

23. $(B - A) - C$

25. $(A \cap B) \cup (B \cap C) \cup (C \cap A)$

27. $A \cup (A')$