2.3 Exercises

✔ CONCEPT CHECK

1. The _____ of two sets is represented by the overlapping region in a Venn diagram.

2. The _____ of two sets contains all elements of the two sets.

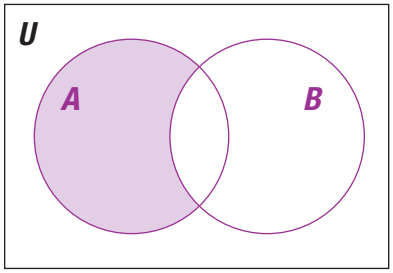
3. De Morgan's Laws are used to find the _____ of the union or intersection of two sets.

4. True or False: If two sets are disjoint, then the cardinality of the union of the two sets is equal to the sum of the cardinality of each set.

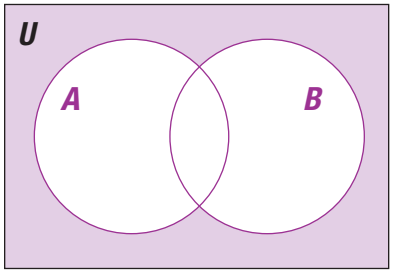
PRACTICE

Use set notation to represent each shaded region.

5.



6.



Show that each pair of sets is equal by drawing a Venn diagram of each set.

7. $A \cap B$ and $B \cap A$

8. $A \cup B$ and $B \cup A$

9. $(A \cap B) \cap C$ and $A \cap (B \cap C)$

10. $(A \cup B) \cup C$ and $A \cup (B \cup C)$

11. $A \cup \varnothing$ and A

Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{2, 4, 6, 8, 10\}$, and $B = \{1, 4, 9\}$.

12. Find $A \cup B$.

13. Find $A \cap B$.

14. Find $|A \cup B|$.

15. Find $|A \cap B|$.

16. Verify $(A \cup B)' = A' \cap B'$.

Let $U = \{1, 2, 3, 5, 8, 13, 21, 34\}$, $X = \{1, 3, 5, 13, 21\}$, and $Y = \{3, 21\}$.

17. Find $X \cup Y$.

18. Find $X \cap Y$.

19. Find $|X \cup Y|$.

20. Find $|X \cap Y|$.

21. Verify $(X \cup Y)' = X' \cap Y'$.

Let $U = \{a, r, c, h, i, v, e, d\}$, $H = \{h, i, r, e, d\}$, and $R = \{r, i, c, h\}$.

22. Find $H \cup R$.

23. Find $H \cap R$.

24. Find $|H \cup R|$.

25. Find $|H \cap R|$.

26. Verify $(H \cap R)' = H' \cup R'$.

Let $U = \{e, d, u, c, a, t, i, o, n\}$, $D = \{d, a, n, c, e\}$, and $N = \{n, o, t, e\}$.

27. Find $D \cup N$.

28. Find $D \cap N$.

29. Find $|D \cup N|$.

30. Find $|D \cap N|$.

31. Verify $(D \cap N)' = D' \cup N'$.

Let $U = \{c, o, p, y, r, i, g, h, t, a, b, l, e\}$, $B = \{b, i, o, g, r, a, p, h, y\}$, $C = \{c, h, i, p, o, t, l, e\}$, and $P = \{p, i, r, a, c, y\}$.

32. Find $B \cap (C \cup P)$.

33. Find $B \cup (C \cap P)$.

34. Find $P \cup (B \cap C)$.

35. Verify $(C \cup P)' = C' \cap P'$.

Let $U = \{m, e, l, t, d, o, w, n, s\}$, $S = \{s, n, o, w, m, e, l, t\}$, $M = \{m, o, d, e, l\}$, and $T = \{t, o, w, e, d\}$.

36. Find $S \cap (M \cup T)$.

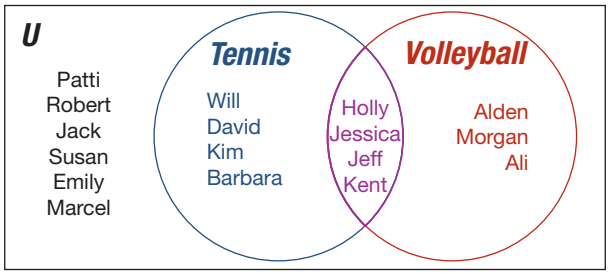
37. Find $S \cup (M \cap T)$.

38. Find $T \cup (S \cap M)$.

39. Verify $(M \cap T)' = M' \cup T'$.

APPLICATIONS

Use the Venn diagram to solve each problem.



40. Which students played only tennis?

41. Determine which students played tennis or volleyball.

42. Determine which students played tennis and volleyball.

43. Find the number of students that play tennis or volleyball.

Solve.

44. A grocery store found that 275 of its customers use push carts to shop, 185 used a carry basket to shop, and that 145 used both a push cart and a carry basket. How many customers use only a push cart or a carry basket? Draw the Venn diagram.

45. Determine the number of playing cards in a standard deck that are red cards or face cards.

46. Determine the number of playing cards in a standard deck that are odd numbered cards or black cards.

2.3 PROJECT

EXPLORING INTERVALS: INTERSECTIONS AND UNIONS

In Section 2.3, you learned about the intersection and union of sets. In this activity, you will investigate intersections involving sets that cannot be described using roster notation.

Consider the set I_1 of all real numbers that are greater than or equal to 0 and less than or equal to 1. Using set-builder notation, we have $I_1 = \{x \mid 0 \le x \le 1\}$, which we can also represent using interval notation as $I_1 = [0,1]$ or graphically as shown in Figure 1.

Figure 1