1.3 Intersection and Union of Two Sets

GETTING STARTED

Answer each of the following using set notation.

1. All the numbers we'll be using in this question are the integers from 1 to 10.

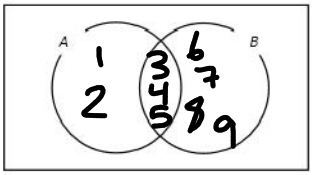
$U = \{1, 2, 3, \ldots, 8, 9, 10\}$

2. The first set, which we'll call *A*, are the numbers from 1 to 5.

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

3. The second set, which we'll call *B*, are the numbers 3 to 9. Complete the Venn diagram.

$B = \{3, 4, 5, 6, 7, 8, 9\}$

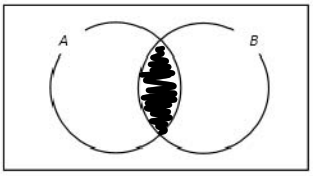


4. "All the elements of *A* and all the elements of *B*." Show this in set notation and shade the appropriate region.

$A \cup B$

5. Elements that are common to *A* and *B*. Show this in set notation and shade the appropriate region.

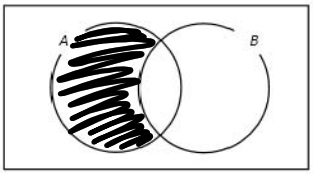
$A \cap B$



6. The elements that are in *A* but not in *B*. Show this in set notation and shade the appropriate region.

$A \setminus B$

"set difference" = minus



$A \setminus B$

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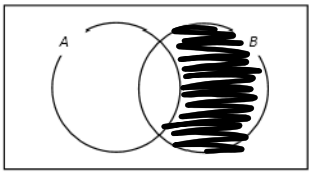
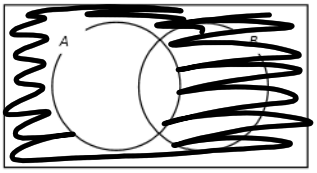
7. The elements that are in *B* but not in *A*. Show this in set notation and shade the appropriate region.

$B \setminus A$



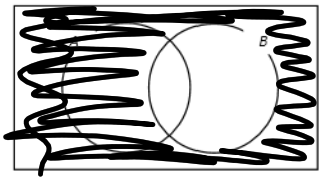
8. The elements that are not in *A*. Show this in set notation and shade the appropriate region.

A'



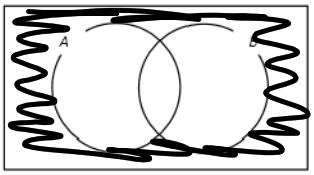
9. The elements that are not in *B*. Show this in set notation and shade the appropriate region.

B'



10. The elements that are not in *A* or *B*. Show this in set notation and shade the appropriate region.

$(A \cup B)'$



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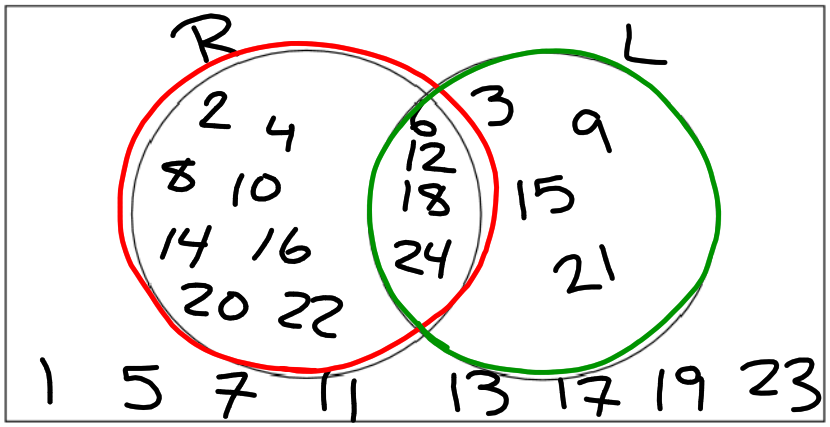
INVESTIGATE the Math page 22.

Read about Jacquie the zookeeper on page 22.

T = {1, 2, 3, ..., 22, 23, 24}
R = {2, 4, 6, ..., 20, 22, 24}
L = {3, 6, 9, ..., 18, 21, 24}

A. List the sets *T*, *R*, and *L* in a Venn diagram.



B. List the elements of the *complement* of the union of *R* and *L*.

$(R \cup L)' = \{1, 5, 7, 11, 13, 17, 19, 23\}$

C. Complete each statement with "and" or "or".

a. The set $R \cap L$ consists of the elements in set *R* and set *L*.

b. The set $R \cup L$ consists of the elements in set *R* or set *L*.

and $\cap$
or $\cup$

D. The number of elements in $R \cup L$ does NOT equal to the number of elements in *R* plus the number of elements in *L*. What does it equal? Can you make an equation to represent this number using set notation?

$n(R \cup L) \neq n(R) + n(L)$

intersect

$n(R \cup L) = n(R) + n(L) - n(R \cap L)$

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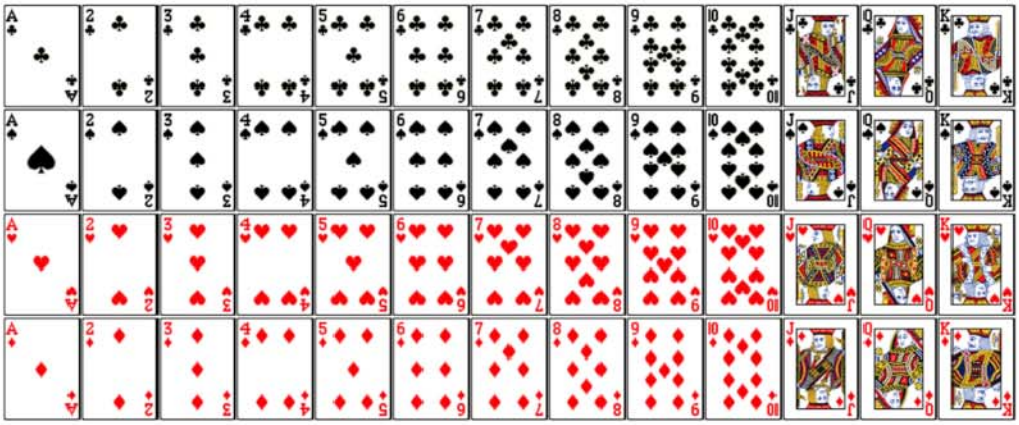
1.3 Examples

Example 1 (Page 24)

If you draw a card at random from a standard deck of cards, you will draw a card from one of four suits: clubs (*C*), spades (*S*), hearts (*H*), or diamonds (*D*):



a) Determine *n(C)*, *n(S)*, *n(H)*, *n(D)* and *n(U)*.

$n(C)=13$
$n(S)=13$
$n(H)=13$
$n(D)=13$
$n(U)=52$

b) Determine the union of *S* and *H*. Determine $n(S \cup H)$.

$n(S \cup H) = 13+13-0 = 26$

c) Describe the intersection of *S* and *H*. Determine $n(S \cap H)$.

$n(S \cap H) = \emptyset = \{\}$

d) Determine whether the events that are described by sets *S* and *H* are mutually exclusive, and whether sets *S* and *H* are disjoint.

both

no elements in common

two events that cannot happen at the same time

e) Describe the complement of $S \cup H$.

$D \cup C$

f) Is the statement $n(S)+n(H)=n(S \cup H)$ true?

Yes, only because $n(S \cap H)=\emptyset$.

disjoint

Example 2 (page 26)

- The athletics department at a large high school offers 16 different sports:

Badminton I	Hockey I	Tennis B I	Basketball B
Lacrosse B I	Ultimate ∅	X-C running ∅	Rugby B
Volleyball B	Curling I	X-C skiing I	Wrestling ∅
Football B	Soccer B	Golf B I	softball B I

Using set notation and/or Venn diagrams, determine the number of sports that require the following types of equipment:

a. A ball and an implement (like a stick, club, racquet).

$n(B \cap I) = 4$

b. Only a ball.

$n(B \setminus I) = 5$

c. An implement but not a ball.

$n(I \setminus B) = 4$

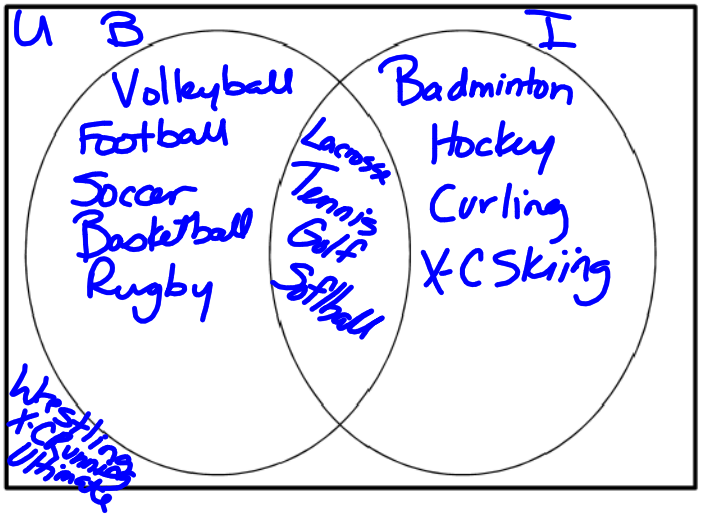
d. Either a ball or an implement.

$n(B \cup I) = 13$

e. Neither a ball nor an implement.

$n(B \cup I)' = 3$

Venn diagram



Example 3 (Page 28)

Jammal surveyed 34 people at his gym. He learned that 16 people do weight training three times per week, 21 people do cardio training three times per week and 6 people train fewer than three times per week. Summarize his results using a Venn diagram.

$n(U) = 34$

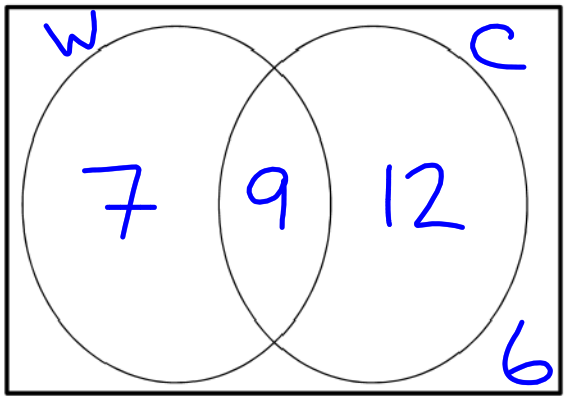
$34 - 6 = 28$

$n(W) + n(C) - x = n(W \cup C)$

$16 + 21 - x = 28$

$37 - x = 28$

$x = 9$

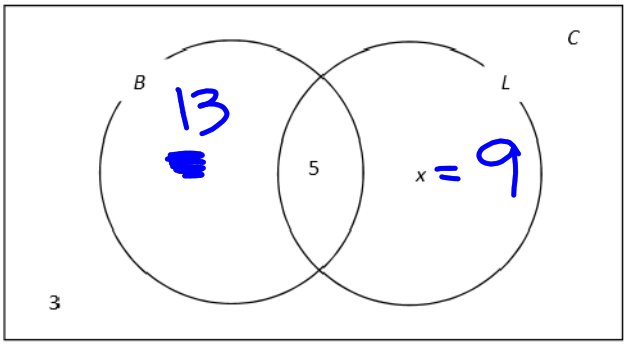


Example 4 (Page 29)

Morgan surveyed 30 students in her mathematics class about their eating habits. Eighteen of these students eat breakfast, five eat a healthy lunch and three do not eat breakfast or a healthy lunch. She asked Tyler "can you figure out how many students eat a healthy lunch?" Tyler completed the below Venn diagram and found x to be 9. Tyler made an error. Can you find the error he made? How many people do eat a healthy lunch? $= 14$

$n(U) = 30$

$n(B \cup L) = 27$



Extra Question:

Your Turn, page 28.

Jamaal survey 50 other gym members. Of these members, 9 train fewer than three times per week, 11 do just cardio three times per week and 16 do both cardio and weight training three times per week. Use a Venn diagram to determine how many of these members weight train three times per week.

Page 32 #1, 2, 3, 4, 6, 7, 8, 9