Assignments for Prob/Stat/Discrete
Unit 1: Set Theory

Day	Date	Assignment (Due the next class meeting)
		1.1 Worksheet
		1.2 Worksheet
		1.3 Worksheet
		1.4 Worksheet
		1.5 Worksheet
		Unit 1 Practice Test
		Unit 1 Test

NOTE: You should be prepared for daily quizzes.

HW reminders:

- If you cannot solve a problem, get help **before** the assignment is due.
- Help is available before school, during lunch, or during IC.
- For extra practice, visit www.interactmath.com
- Don't forget that you can get 24-hour math help from www.smarthinking.com or mathguy.us

1.1: Basic Set Concepts

Objectives
1. Use three methods to represent sets
2. Define and recognize the empty set
3. Use the symbols $\in$ and $\notin$.
4. Apply set notation to sets of natural numbers.
5. Determine a set's cardinal number.
6. Recognize equivalent sets.
7. Distinguish between finite and infinite sets.
8. Recognize equal sets.

Sets

- A collection of objects whose contents can be clearly determined.
- ______________ or _______________ are the objects in a set.
- A set must be ______ _________, meaning that its contents can be clearly determined.
- The order in which the __________________ of the set are listed is not important.

Methods for Representing Sets

Capital letters are generally used to name sets.

- Word description: Describing the members:

  Set W is the set of the days of the week.
- Roster method: Listing the members:

W = {Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}

Commas are used to separate the elements of the set.

Braces are used to designate that the enclosed elements form a set.

Example 1
Representing a Set Using a Description

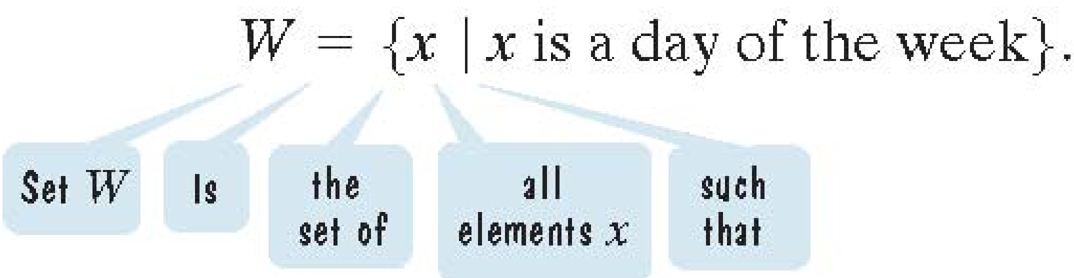
Write a word description of the set:

P = {Washington, Adams, Jefferson, Madison, Monroe}

Example 2
Representing a Set Using the Roster Method

Write using the roster method:
Set C is the set of U.S. coins with a value of less than a dollar.

Set-Builder Notation



Before the vertical line is the variable x, which represents an element in general

After the vertical line is the condition x must meet in order to be an element of the set.

Example 3
Converting from Set-Builder to Roster Notation

Express set

A = {x | x is a month that begins with the letter M}

Using the roster method.

The Empty Set

- Also called the _________ __________

- Set that contains _____ elements
- Represented by { } or Ø
- The empty set is NOT represented by { Ø }. This notation represents a set containing the element Ø.
- These are examples of empty sets:
  - Set of all numbers less than 4 and greater than 10
  - {x | x is a fawn that speaks}

Example 4
Recognizing the Empty Set

- Which of the following is the empty set?

a. {0}

b. 0

c. { x | x is a number less than 4 or greater than 10 }

d. { x | x is a square with three sides}

Notations for Set Membership

- $\in$ is used to indicate that an object is an ___________________ of a set. The symbol $\in$ is used to replace the words "is an element of."
- $\notin$ is used to indicate that an object is ________ _____ _____________ of a set. The symbol $\notin$ is used to replace the words "is not an element of."

Example 5
Using the symbols $\in$ and $\notin$

Determine whether each statement is true or false:

a. r $\in$ {a,b,c,…,z}

b. 7 $\notin$ {1,2,3,4,5}

c. {a} $\in$ {a,b}

Example 6

Sets of Natural Numbers

N = {1,2,3,4,5,…}

Ellipsis, the three dots after the 5 indicate that there is no final element and that the listing goes on forever.

Express each of the following sets using the roster method

a. Set A is the set of natural numbers less than 5.

b. Set B is the set of natural numbers greater than or equal to 25.

c. E = { x| x $\in$N and x is even}.

Inequality Notation and Sets

Inequality Symbol and Meaning	Set Builder Notation	Roster Method
$x < a$ — x is less than a.	$\{x \mid x \in \mathbf{N} \text{ and } x < 4\}$ — x is a natural number less than 4.	$\{1, 2, 3\}$
$x \leq a$ — x is less than or equal to a.	$\{x \mid x \in \mathbf{N} \text{ and } x \leq 4\}$ — x is a natural number less than or equal to 4.	$\{1, 2, 3, 4\}$
$x > a$ — x is greater than a.	$\{x \mid x \in \mathbf{N} \text{ and } x > 4\}$ — x is a natural number greater than 4.	$\{5, 6, 7, 8, \dots\}$
$x \geq a$ — x is greater than or equal to a.	$\{x \mid x \in \mathbf{N} \text{ and } x \geq 4\}$ — x is a natural number greater than or equal to 4.	$\{4, 5, 6, 7, \dots\}$
$a < x < b$ — x is greater than a and less than b.	$\{x \mid x \in \mathbf{N} \text{ and } 4 < x < 8\}$ — x is a natural number greater than 4 and less than 8.	$\{5, 6, 7\}$
$a \leq x \leq b$ — x is greater than or equal to a and less than or equal to b.	$\{x \mid x \in \mathbf{N} \text{ and } 4 \leq x \leq 8\}$ — x is a natural number greater than or equal to 4 and less than or equal to 8.	$\{4, 5, 6, 7, 8\}$
$a \leq x < b$ — x is greater than or equal to a and less than b.	$\{x \mid x \in \mathbf{N} \text{ and } 4 \leq x < 8\}$ — x is a natural number greater than or equal to 4 and less than 8.	$\{4, 5, 6, 7\}$
$a < x \leq b$ — x is greater than a and less than or equal to b.	$\{x \mid x \in \mathbf{N} \text{ and } 4 < x \leq 8\}$ — x is a natural number greater than 4 and less than or equal to 8.	$\{5, 6, 7, 8\}$

Example 7
Representing Sets of Natural Numbers

Express each of the following sets using the roster method:
a. $\{ x \mid x \in \mathbb{N} \text{ and } x \leq 100\}$

b. $\{ x \mid x \in \mathbb{N} \text{ and } 70 \leq x < 100 \}$

Example 8
Cardinality of Sets

The ____________ ____________ of set A, represented by *n*(A), is the number of distinct elements in set A.

Find the cardinal number of each set:
a. A = { 7, 9, 11, 13 }

b. B = { 0 }

c. C = { 13, 14, 15,…,22, 23}

Equivalent Sets

Set A is ______________________ to set B if set A and set B contain the same number of elements. For equivalent sets, *n*(A) = *n*(B).

$n(A) = n(B) = 5$

$$A = \{x \mid x \text{ is a vowel}\} = \{\text{a, e, i, o, u}\}$$
$$\updownarrow \ \updownarrow \ \updownarrow \ \updownarrow \ \updownarrow$$
$$B = \{x \mid x \in \mathbf{N} \text{ and } 3 \leq x \leq 7\} = \{3, 4, 5, 6, 7\}.$$

These are equivalent sets:

The line with arrowheads, ↕, indicate that each element of set A can be paired with exactly one element of set B and each element of set B can be paired with exactly one element of set A.

One-To-One Correspondences and Equivalent Sets

- If set A and set B can be placed in a one-to-one correspondence, then A is equivalent to B: $n(A) = n(B)$.
- If set A and set B cannot be placed in a one-to-one correspondence, then A is not equivalent to B: $n(A) \neq n(B)$.

Example 9
Determining if Sets are Equivalent

- This Table shows the celebrities who hosted NBC's *Saturday Night Live* most frequently and the number of times each starred on the show.

A = the set of the five most frequent hosts.

B = the set of the number of times each host starred on the show.

- Are the sets equivalent?

Most Frequent Host of *Saturday Night Live*	
Celebrity	Number of Shows Hosted
Steve Martin	14
Alec Baldwin	12
John Goodman	12
Buck Henry	10
Chevy Chase	9

- Method 1: Trying to set up a One-to-One Correspondence.

- Method 2: Counting Elements

Finite and Infinite Sets, Equal Sets

- ____________ **set**: Set A is a finite set if $n(A) = 0$ (that is, A is the empty set) or $n(A)$ is a natural number.
- ____________ **set:** A set whose cardinality is not 0 or a natural number. The set of natural numbers is assigned the infinite cardinal number $\aleph_0$ read "aleph-null".
- _____________ **sets**: Set A is equal to set B if set A and set B contain exactly the same elements, regardless of order or possible repetition of elements. We symbolize the equality of sets A and B using the statement A = B.

<u>*If two sets are equal, then they must be equivalent!*</u>

Example 10
Determining Whether Sets are Equal

Determine whether each statement is true or false:
a. { 4, 8, 9 } = { 8, 9, 4 }

b. { 1, 3, 5 } = {0, 1, 3, 5 }

1.2: Subsets

Objectives
1. Recognize subsets and use the notation $\subseteq$.
2. Recognize proper subsets and use the notation $\subset$.
3. Determine the number of subsets of a set
4. Apply concepts of subsets and equivalent sets to infinite sets.

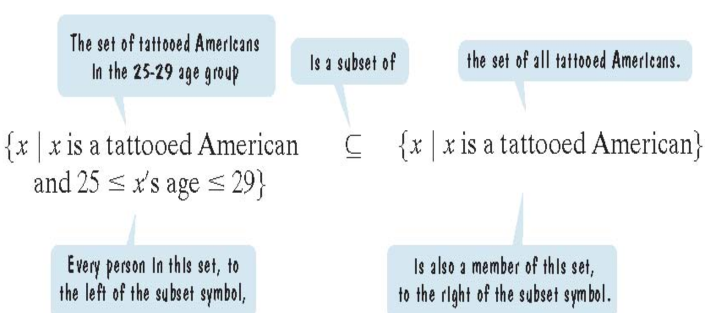
Subsets

- Set A is a __________ of set B, expressed as $A \subseteq B$,

  if every ___________ in set A is also an element in set B.
- The notation $\not\subseteq$ means that A is not a subset of B. A is not a subset of set B if there is at least one element of set A that is not an element of set B.
- Every set is a subset of itself.

Example 1
Subsets

- Applying the subset definition to the set of people age 25 -29 in this table:



Percentage of Tattooed Americans, By Age Group	
Age Group	Percent Tattooed
18-24	13%
25-29	36%
30-39	28%
40-49	14%
50-64	10%
65+	7%

- Given:

A = {1, 2, 3} B = {1, 2 }

Is A a subset of B?

Is B a subset of A?

Example 2

Proper Subsets

- Set A is a _____________ _____________ of set B, expressed as $A \subset B$, if set A is a subset of set B and sets A and B are not equal ($A \neq B$).

Write $\subseteq$, $\subset$, or both in the blank to form a true statement.

A = { x | x is a person and x lives in San Francisco}

B = { x | x is a person and x lives in California}

A ____B

b. A = { 2, 4, 6, 8}

B = { 2, 8, 4, 6}

A ____B

Subsets and the Empty Set

- The Empty Set as a Subset
  1. For any set B, Ø ___ B.
  2. For any set B other than the empty set, Ø ___ B

The Number of Subsets of a Given Set

Set	Number of Elements	List of All Subsets	Number of Subsets
{ }	0	{ }	1
{a}	1	{a},{ }	2
{a,b}	2	{a,b},{a}, {b},{ }	4
{a,b,c}	3	{a,b,c},{a,b}, {a,c},{ b,c }, {a},{b},{c}, { }	8

- As we increase the number of elements in the set by one, the number of subsets ____________.
- The number of subsets of a set with n elements is _____.
- The number of proper subsets of a set with n elements is ________.

Example 3
Finding the Number of Subsets and Proper Subsets

Find the number of subsets and the number of proper subsets.

a. {a, b, c, d, e }

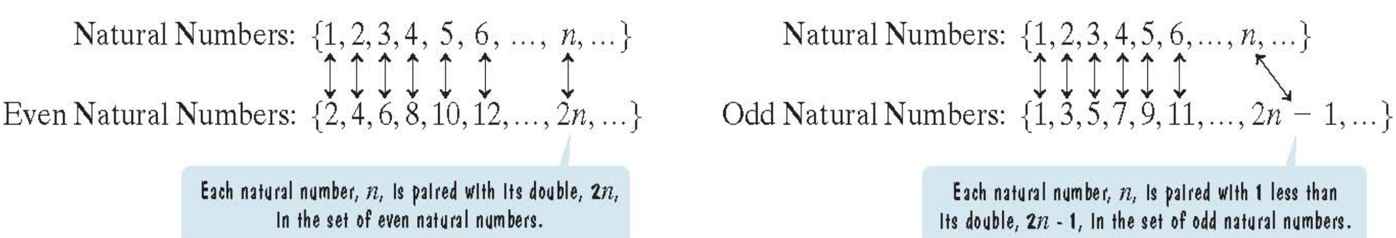
b. { x | x $\in$ N and 9 ≤ x ≤ 15 }

The Number of Subsets of Infinite Sets

- There are $\aleph_0$ natural numbers.
  - It has $2^{\aleph_0}$ subsets.
  - It has $2^{\aleph_0} - 1$ proper subsets
  - $2^{\aleph_0} > \aleph_0$
  - Denote $2^{\aleph_0}$ by $\aleph_1$
  - $\aleph_1 > \aleph_0$
  - $\aleph_0$ is the “smallest” transfinite cardinal number in an infinite hierarchy of different infinities.

Cardinal Numbers of Infinite Sets

Georg Cantor (1845-1918) studied the mathematics of infinity and assigned the transfinite cardinal number $\aleph_0$ to the set of natural numbers. He used one-to-one correspondences to establish some surprising equivalences between the set of natural numbers and its proper subsets.



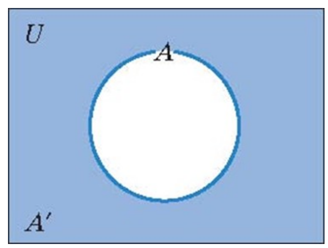
1.3: Venn Diagrams and Set Operations

Objectives

1. Understand the meaning of a universal set.
2. Understand the basic ideas of a Venn diagram.
3. Use Venn diagrams to visualize relationships between two sets.
4. Find the complement of a set.
5. Find the intersection of two sets.
6. Find the union of two sets.
7. Perform operations with sets.
8. Determine sets involving set operations from a Venn diagram.
9. Understand the meaning of *and* and *or*.
10. Use the formula for n (A U B).

Universal Sets and Venn Diagrams

The _____________ ______ is a general set that contains all elements under discussion.
John Venn (1843 – 1923) created Venn diagrams to show the visual relationship among sets.
Universal set is represented by a rectangle
Subsets within the universal set are depicted by circles, or sometimes ovals or other shapes



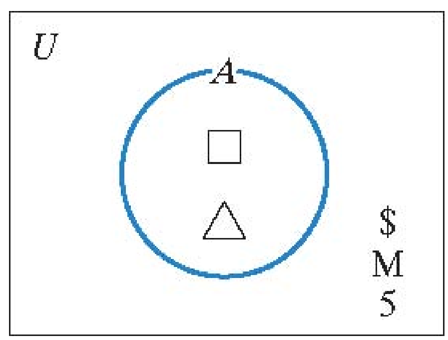
Example 1
Determining Sets From a Venn Diagram

- Use the Venn diagram to determine each of the following sets:

a. U

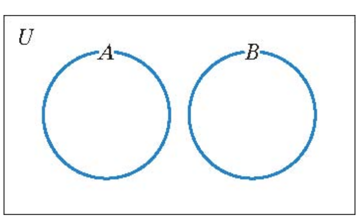
b. A

c. The set of elements in U that are not in A.

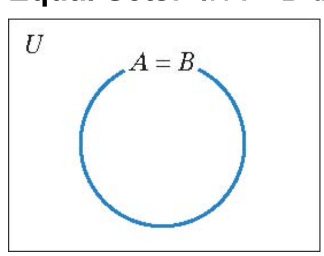


Representing Two Sets in a Venn Diagram

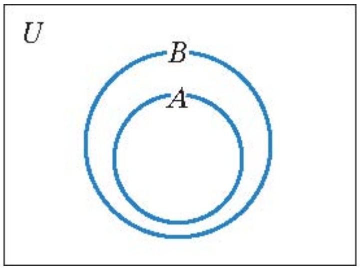
Disjoint Sets: Two sets that have no elements in common.



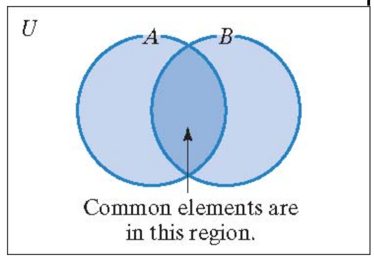
Equal Sets: If A = B then A$\subseteq$B and B $\subseteq$ A.



Proper Subsets: All elements of set A are elements of set B.



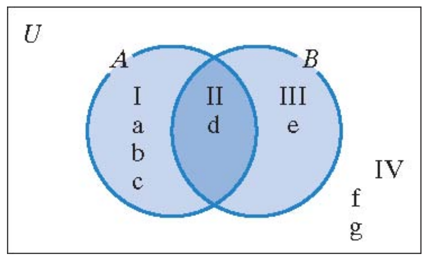
Sets with Some Common Elements Some means "at least one". The representing the sets must overlap.



Example 2
Determining sets from a Venn Diagram

- Use the Venn Diagram to determine:

a. U
b. B
c. The set of elements in A but not B
d. The set of elements in U that are not in B
e. The set of elements in both A and B.

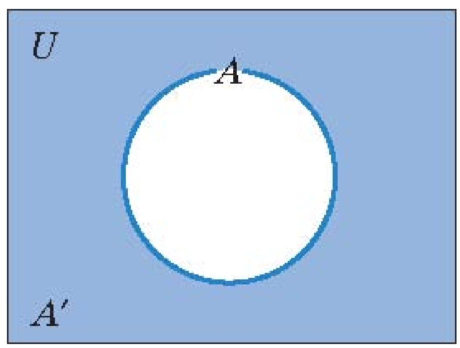


The Complement of a Set

- The ________________ of set A, symbolized by **A'** is the set of all elements in the universal set that are *not* in A. This idea can be expressed in set-builder notation as follows:

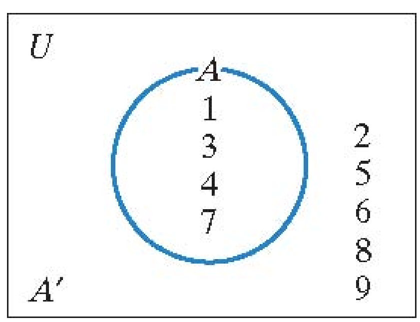
A' = {x | x $\in$ U and x $\notin$ A}

- The shaded region represents the complement of set A. This region lies outside the circle.



Example 3
Finding a Set's Complement

- Let U = { 1, 2, 3, 4, 5, 6, 7, 8, 9} and A = {1, 3, 4, 7 }. Find A'.



The Intersection and Union of Sets

- The ___________________ of sets A and B, written **A∩B**, is the set of elements common to both set A and set B. This definition can be expressed in set-builder notation as follows:

$$\mathbf{A \cap B = \{\ x \mid x \in A \text{ and } x \in B\}}$$

- The ____________ of sets A and B, written **AUB** is the set of elements are in A or B or in both sets. This definition can be expressed in set-builder notation as follows:

$$\mathbf{A \cup B = \{\ x \mid x \in A \text{ or } x \in B\}}$$

- For any set A:
  - $A \cap \emptyset = \emptyset$
  - $A \cup \emptyset = A$

Example 4
Finding the Intersection of Two Sets

- Find each of the following intersections:

a. $\{7, 8, 9, 10, 11\} \cap \{6, 8, 10, 12\}$

b. $\{1, 3, 5, 7, 9\} \cap \{2, 4, 6, 8\}$

c. $\{1, 3, 5, 7, 9\} \cap \emptyset$

Example 5
Finding the Union of Sets

- Find each of the following unions:

a. $\{7, 8, 9, 10, 11\} \cup \{6, 8, 10, 12\}$

b. $\{1, 3, 5, 7, 9\} \cup \{2, 4, 6, 8\}$

c. $\{1, 3, 5, 7, 9\} \cup \emptyset$

Example 6
Performing Set Operations

Given:

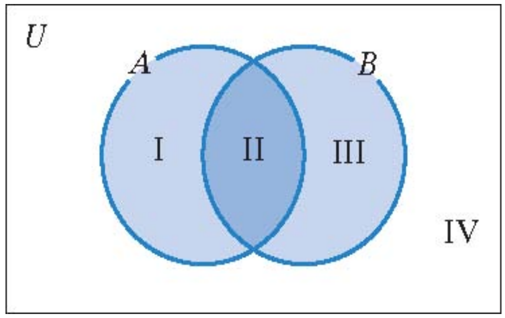
$U = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{ 1, 3, 7, 9 \}$
$B = \{ 3, 7, 8, 10 \}$

- Find

a. $(A \cup B)'$

b. $A' \cap B'$

Example 7
Determining Sets from a Venn Diagram



Set to Determine	Description of Set	Regions in Venn Diagram
a. $A \cup B$		
b. $(A \cup B)'$		
c. $A \cap B$		
d. $(A \cap B)'$		
e. $A' \cap B$		
f. $A \cup B'$		

Sets and Precise Use of Everyday English

- Set operations and Venn diagrams provide precise ways of ________________, ____________________, and ____________________ the vast array of sets and subsets we encounter every day.
- _____ refers to the union of sets
- _______ refers to the intersection of sets

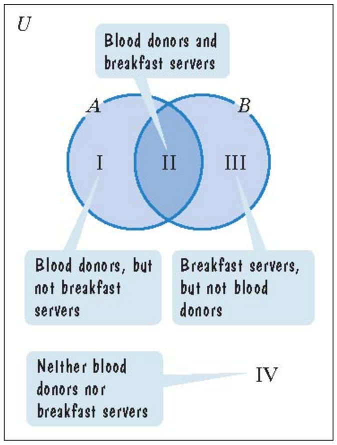
Example 8
The Cardinal Number of the Union of Two Finite Sets

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

The number of elements in A or B | is | the number of elements in A plus the number of elements in B | minus the number of elements in A and B.

- Some of the results of the campus blood drive survey indicated that 490 students were willing to donate blood, 340 students were willing to help serve a free breakfast to blood donors, and 120 students were willing to do both.

  How many students were willing to donate blood **or** serve breakfast?



A: Set of blood donors
B: Set of breakfast servers

1.4 Set Operations and Venn Diagrams with Three Sets

Objectives

1. Perform set operations with three sets.
2. Use Venn diagrams with three sets.
3. Use Venn diagrams to prove equality of sets.

Example 1
Set Operations with Three Sets

- Given

U = {1, 2, 3, 4, 5, 6, 7, 8, 9}

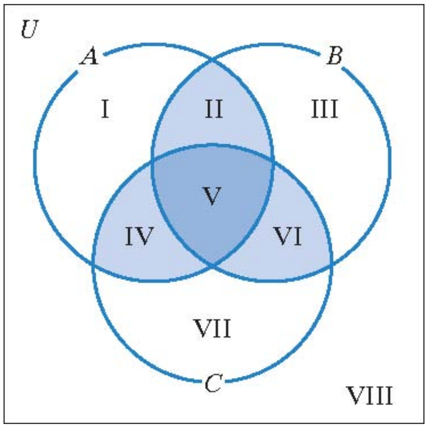
A = {1, 2, 3, 4, 5}

B = {1, 2, 3, 6, 8}

C = {2, 3, 4, 6, 7}

- Find A ∩ (B U C')

Venn diagrams with Three Sets



The Region Shown in Dark Blue

Region V	This region represents elements that are common to sets A, B, and C: $A \cap B \cap C$.

The Regions Shown in Light Blue

Region II	This region represents elements in both sets A and B that are not in set C: $(A \cap B) \cap C'$.
Region IV	This region represents elements in both sets A and C that are not in set B: $(A \cap C) \cap B'$.
Region VI	This region represents elements in both sets B and C that are not in set A: $(B \cap C) \cap A'$.

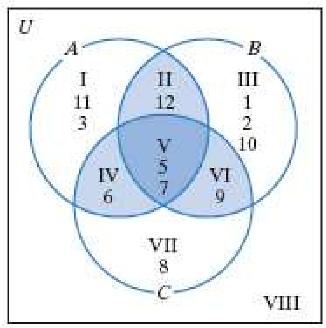
The Regions Shown in White

Region I	This region represents elements in set A that are in neither sets B nor C: $A \cap (B' \cap C')$.
Region III	This region represents elements in set B that are in neither sets A nor C: $B \cap (A' \cap C')$.
Region VII	This region represents elements in set C that are in neither sets A nor B: $C \cap (A' \cap B')$.
Region VIII	This region represents elements in the universal set U that are not in sets A, B, or C: $A' \cap B' \cap C'$.

Example 2
Determining Sets from a Venn Diagram with Three Intersecting Sets

Use the Venn diagram to find:

a. A
b. A U B
c. B ∩ C
d. C'
e. A ∩ B ∩ C



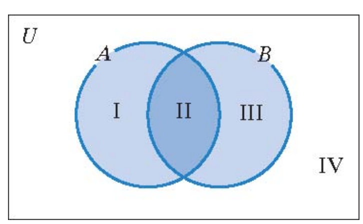
Example 3
Proving the Equality of Sets

- Prove that (A ∩ B)' = A' U B'
- Hint

We can apply deductive reasoning using a Venn diagram to prove this statement is true for *all* sets A and B.
If both sets represent the same regions in this general diagram then this proves that they are equal.

Prove that (A ∩ B)' = A' U B'

Hint: Begin with the regions represented by (A ∩ B)'.



Next, find the regions

Represented by A'U B'.

De Morgan's Laws

- (A ∩ B)' = A' U B'

The complement of the intersection of the two sets is the union of the complements of those sets.

- (A U B)' = A' ∩ B'

The complement of the union of two sets is the intersection of the complements of those sets.

1.5 Survey Problems

Objectives
1. Use Venn Diagrams to visualize a survey's results.
2. Use survey results to complete Venn diagrams and answer questions about the survey.

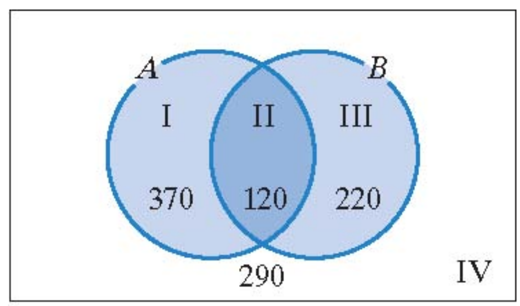
Example 1
Visualizing the Results of a Survey

The results of the survey are summarized in this figure.

a. How many students are willing to donate blood?

b. How many are willing to donate blood but not serve breakfast?

c. How many weren't willing to do either?



A: Set of students willing to donate blood
B: Set of students willing to serve breakfast to donors

Solving Survey Problems

1. Use the survey's _______________ to define sets and draw a Venn diagram.
2. Use the survey's _______________ to determine the cardinality for each region in the Venn diagram. **Start with the intersection of the sets, the _________________ region, and work outward.**
3. Use the completed Venn diagram to answer the problem's questions.

Example 2
Surveying People's Attitudes

A survey is taken that asks 2000 randomly selected U.S. and Canadian adults the following question: Do you agree or disagree that the primary cause of poverty is societal injustice?

The results of the survey showed that:

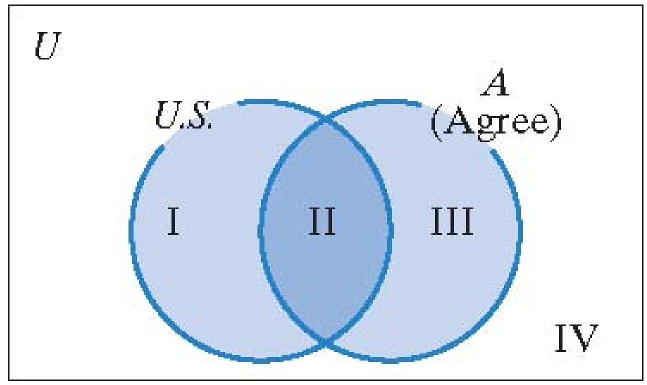
1060 people agreed with the statement

400 Americans agreed with the statement.

If half the adults surveyed were Americans

a. How many Canadians agreed with the statement?

b. How many Canadians disagreed with the statement?

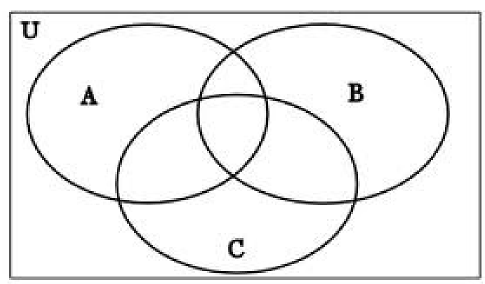


Example 3
Constructing a Venn Diagram for a Survey

Sixty People were contacted and responded to a movie survey. The following information was obtained:

a. 6 people liked comedies, dramas, and science fiction
b. 13 people like comedies and dramas
c. 10 people liked comedies and science fiction
d. 11 people liked dramas and science fiction
e. 26 people liked comedies
f. 25 people liked science fiction
g. 21 people liked dramas

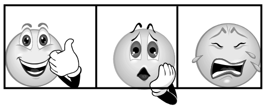
Use a Venn diagram to illustrate the surveys results.



Example 4
Use the Venn Diagram created in example 3 to answer the following:
How many people liked

a. Comedies, but neither dramas nor science fiction?
b. Dramas and science fiction, but not comedies?
c. Dramas or science fiction, but not comedies?
d. Exactly one movie style?
e. At least two move styles?
f. None of the movie styles?

Discrete Math **Name**____
Unit 1 Objectives



Objective #1: Can you use the symbols $\in$ and $\notin$? 2.1

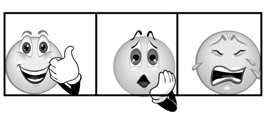
For exercises 1-4, write 'T' if the statement is true and 'F' if the statement is false.

1. $33 \notin \{1, 2, 3, \ldots, 40\}$

2. $10 \in \{1, 2, 3, \ldots, 15\}$

3. $7 \in \{1, 3, 5, 7, 9\}$

4. $17 \notin \{1, 2, 3, \ldots, 10\}$



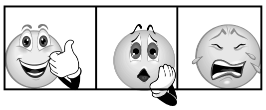
Objective #2: Can you determine a sets Cardinal number?

For exercises 1-3, find the cardinal number for the set.

1. $\{27, 29, 31, 33, 35\}$

2. $\{8, 10, 12, \ldots, 66\}$

3. $\{x \mid x \text{ is a letter of the alphabet}\}$



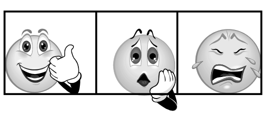
Objective #3: Can you use the roster method?

For exercises 1 and 2, express the set using the roster method. Remember that N represents the set of natural numbers.

1. {x| x is a color in the American Flag}

2. {x| x $\in$ **N** and *x* is greater than 15 }

3. List the elements in the set of the days of the week



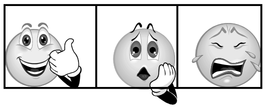
Objective #4: Can you recognize equivalent sets?

For exercises 1-3, determine whether the sets are equivalent.

1. A = {19, 20, 21, 22, 23}
   B = {18, 19, 20, 21, 22}

2. A = {31, 33, 35, 37, 39}
   B = {32, 34, 36, 38, 40}

3. *A* is the set of residents age 25 or older living in the United States
   B is the set of residents age 25 or older registered to vote in the United States

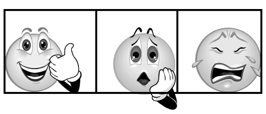


Objective #5: Can you recognize equal sets?

For exercises 1 and 2, determine whether the sets are equal.

1. A = {15, 16, 17, 18, 19}
B = {14, 15, 16, 17, 18}

2. A = {11, 12, 12, 13, 13, 13, 14, 14, 14, 14}
B = {14, 13, 12, 11}



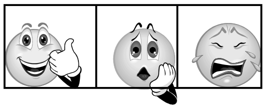
Objective #6: Can you recognize subsets and use the notation $\subseteq$?

For exercises 1-3, determine whether the statement is true or false.

1. Bob $\subseteq$ {Bob, Carol, Ted, Alice}

2. {Ted} $\subseteq$ {Bob, Carol, Ted, Alice}

3. Ø $\subseteq$ { France, Germany, Switzerland}



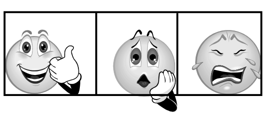
Objective #7: Can you recognize proper subsets and use the notation $\subset$?

For exercises 1-3, use $\subseteq$, $\not\subset$, $\subset$ or both $\subset$ and $\subseteq$ to make a true statement.

1. {6, 7, 8,} ____ {6, 7, 8}

2. {x |x is a male who lives in the U.S.} ____ {x |x is a male who is 15 years old)

3. {a, b} __ {z, a, y, b, x, c}

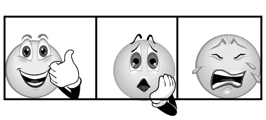


Objective #8: Can you determine the number of subsets in a set?

For exercises 1 and 2, calculate the number of subsets and the number of proper subsets for the set.

1. {1, 3, 5, 7, 9, 11}

2. The set of words describing the colors on a stoplight

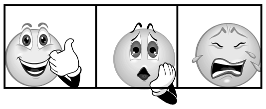


Objective #9: Can you find the complement of a set? 2.3 PG 33 #1 and make a #2 that says list the elements in set B'.

For exercises 1 and 2, let **U = {q, r, s, t, u, v, w, x, y, z}**
A = {q, s, u, w, y}
B = {q, s, y, z}
C = {v, w, x, y, z}

1. List the elements in set A'.

2. List the elements in set B'.



Objective #10: Can you find the intersection or union of two sets?

For exercises 1-5, let

U = {q, r, s, t, u, v, w, x, y, z}
A = {q, s, u, w, y}
B = {q, s, y, z}
C = {v, w, x, y, z}

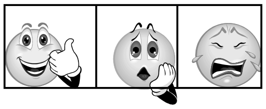
1. List the elements in set $A \cap B$.

2. List the elements in set $B \cup C$.

3. List the elements in set $B \cup U$.

4. List the elements in set $C \cup \emptyset$.

5. List the elements in set $A \cap B'$.



Objective #11: Can you perform operations with sets?

For exercises 1-6, let

$U = \{q, r, s, t, u, v, w, x, y, z\}$
$A = \{q, s, u, w, y\}$
$B = \{q, s, y, z\}$
$C = \{v, w, x, y, z\}$

1. List the elements in set $A' \cup B$.

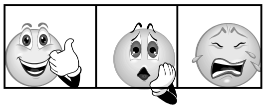
2. List the elements in set $(A \cap C)'$.

3. List the elements in set $(A \cup B)'$.

4. List the elements in set $(A \cap B)'$.

5. List the elements in set $C' \cup A'$.

6. List the elements in set $C' \cap A'$.



Objective #12: Can you perform set operations with three sets?

For exercises 1-3, let $U = \{q, r, s, t, u, v, w, x, y, z\}$
$A = \{q, s, u, w, y\}$
$B = \{q, s, y, z\}$
$C = \{v, w, x, y, z\}$

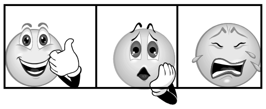
1. List the elements in set $A \cap (B \cup C)$.

2. List the elements in set $A \cup (B \cap C)$.

3. List the elements in set $(A \cup B) \cap (A \cup C)$.

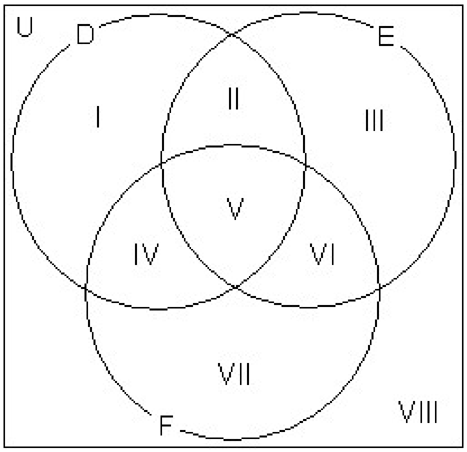
4. List the elements in set $(A \cap B \cap C)'$.

5. List the elements in set $(A \cup B \cup C)'$.



Objective #13: Can you use Venn diagrams with three sets?

For exercises 1-4, use the Venn diagram shown to answer the question.

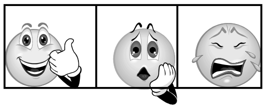


1. Which regions represent set E?

2. Which regions represent set E'?

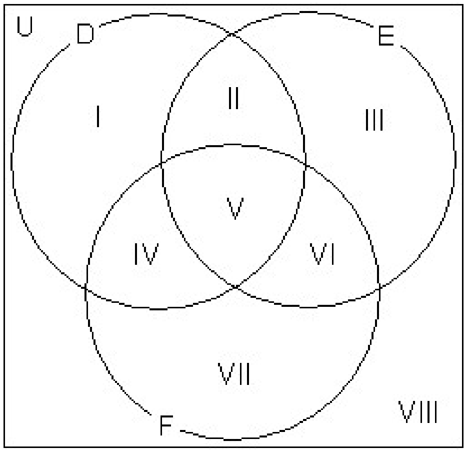
3. Which regions represent set D ∩ E?

4. Which regions represent set D U F?

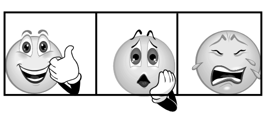


Objective #14: Can you use Venn diagrams to prove equality of sets?

For exercise 1, use the Venn diagram shown to answer the question.



1. Show that $E \cup (D \cap F) = (D \cup E) \cap (E \cup F)$.



Objective #15: Can you use Venn Diagrams to visualize a survey's results?

1. A pollster conducting a telephone poll asked two questions:

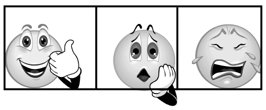
   Question #1. Would you like to live to be 100 years old, if it was possible?
   Question #2. Do you have the confidence that medical science will find cures for major diseases during your lifetime?

   Construct a Venn diagram that allows the respondents to the poll to be identified by whether or not they want to live to be 100 and whether or not they believe cures for major diseases will be found.

Write the letter **q** in the region of the diagram that identifies those who would like to live to be 100 and who believe cures will be found.

Write the letter **t** in the region of the diagram that identifies those who would not like to live to be 100 and who believe cures will be found.

Write the letter **v** in the region of the diagram that identifies those who would not like to live to be 100 and who do not believe cures will be found.



Objective #16: Can you Use survey results to complete Venn diagrams and answer questions about the survey?

2. A pollster conducting a telephone poll asked three questions:

Question #1. Are you a registered voter?
Question #2. Do you currently have any children in grades kindergarten through 12^{th} grade?
Question #3. Would you support a tax increase to build a new school?

Construct a Venn diagram with three circles that can assist the pollster in tabulating the responses to the three questions.

Write the letter **h** in the region of the diagram that identifies all registered voters polled who do not have children in school and who do not support a tax increase.

Write the letter **j** in the region of the diagram that identifies people who are not registered to vote, do not have children in school, and who do not support a tax increase.

Write the letter **k** in the region of the diagram that identifies all registered voters polled who have children in school and who do not support a tax increase.