

# Grade 8 Mathematics

## Data Analysis, Probability, and Discrete Mathematics:

### Lesson 3

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol ( $\Rightarrow$ ) by them.

#### *Purpose of Lesson 3:*

- In this lesson, the tutor and the students will
  - ✓ use Venn diagrams involving 2 or 3 overlapping categories to solve logic problems; and
  - ✓ demonstrate informal understanding of logic problems.

#### *Equipment/Materials Needed:*

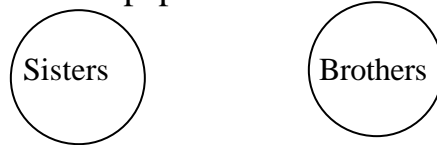
- Copies of Student Sheets 51 – 53
- Paper and pencils
- Small pieces of paper about one square inch (one for each student)

#### *Preparations before beginning Lesson 3:*

- Run off one copy of Student Sheets 51 – 53 for each student.
- Have paper and pencils available.
- Cut out the pieces of paper.

### Lesson 3: Data Analysis

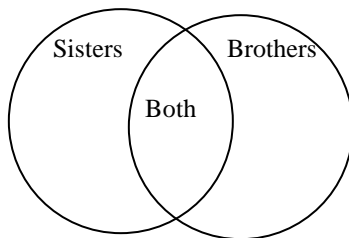
⇒ Draw 2 large circles on a sheet of paper. Write *sisters* in one and *brothers* in the other. Give each student the small piece of paper. Have each student write his/her name on the paper.



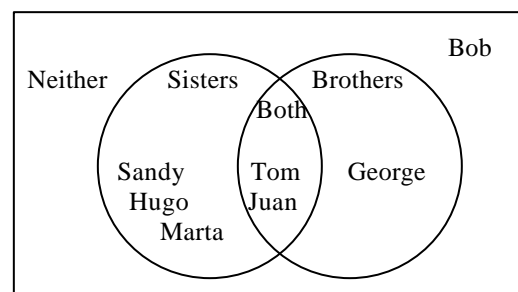
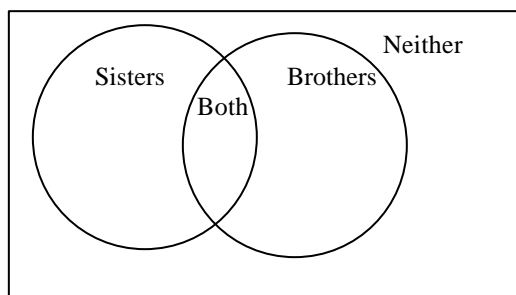
Say:

**If you have a sister, put your name in the circle labeled *sisters*. If you have a brother, put your name in the circle labeled *brothers*. Did anyone have a problem?** (Some students have both brothers and sisters; some have neither.) **Does anyone have an idea of what we could do to take care of these problems?** Hopefully, someone will give these answers. If not, lead the students through the process. (We could overlap the circles and have a place where we could write something like “both.”)

⇒ Draw 2 large circles on another sheet of paper. This time overlap the circles, and write *sisters*, *brothers*, and *both* in the circles.



Have each student place his/her name in the correct place in the circles. **Now we have taken care of those who have both brothers and sisters, what could we do for those who have neither?** (We could draw a rectangle around the circles and put the names of those with neither in the rectangle.)



⇒ Write these names in the circles.

Say:

**How many people have both brothers and sisters? (2) How many people have sisters? (5, only sisters: Sandy, Hugo, Marta; only brothers: Tom and Juan) How many have only brothers? (1) How many have neither? (1)**

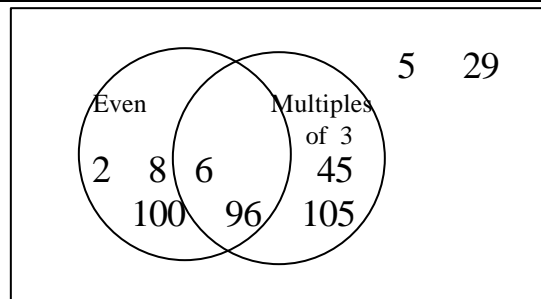
Say:

**What we have drawn is a Venn diagram. A *Venn diagram* is a drawing that shows relationships among sets of data. Venn diagrams are also called *logic rings* in some books.**

⇒ Give Student Sheet 51 to the students.

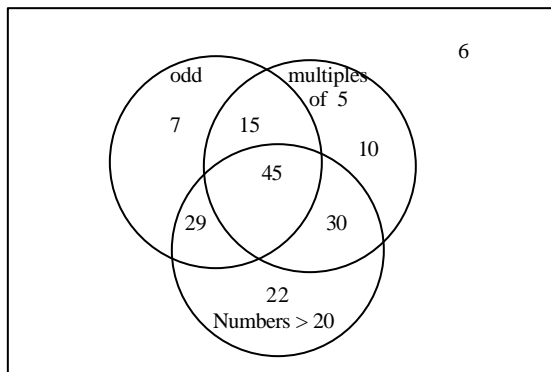
Say:

**Look at the Venn diagram in Part A. As I call out numbers, write them in the correct part of the Venn Diagram. 2, 6, 8, 5, 29, 45, 100, 105, 96. Why was 6 placed in the overlapping part of the two circles? (It is an even number, and it is a multiple of 3.) Why was 5 placed outside the circles? (It is neither even nor a multiple of 3.) What kind of numbers would be in the overlapping part of the two circles? (multiples of 3 that are also even numbers) What kind of numbers would be outside of the circles, but inside the rectangle? (odd numbers that are not multiples of 3)**



Say:

**Sometimes we use Venn diagrams to show more than two categories. Look at Part B. As I call out numbers write them in the correct part of the Venn Diagram. 10, 45, 6, 29, 30, 15, 7, 22 Note: Take time with each number and let the students discuss where each number belongs. What kind of numbers would be in the overlapping part of the 3 circles? (multiples of 5 that are odd numbers and that are greater than 20) What kind of numbers would be outside of the circles, but inside the rectangle? (even numbers that are not multiples of 5 and are less than 20)**



Say:

**Often you will be given problems that you need to solve by thinking logically. This process is called *logical reasoning*. You need to decide how the facts in a problem are related. Usually if you draw a picture, make a table, or make a list you can see the relationships.**

⇒ Give Student Sheet 52 to the students.

Say:

**Look at problem 1. What is the problem asking?** (In what order did the students finish the race?) **What could you do to organize the clues.** (Some will draw a picture, showing 1<sup>st</sup> place, 2<sup>nd</sup> place, etc. Others will make a list.) Let them talk about what might help. **What does the first clue tell you?** (Carley finished between Julia and Jack, so it could look like either of these.)

Winner                      Julia    Carley    Jack

Winner                      Jack    Carley    Julia

**What does the second clue tell you?** (Lilly finished before Julia, so it could look like this. This clue did not help us much.)

Winner                      Lilly    Julia    Carley    Jack

Winner                      Lilly    Jack    Carley    Julia

Winner                      Jack    Lilly    Carley    Julia

Winner                      Jack    Carley    Lilly    Julia

**What does the third clue tell you?** Jack finished in last place. That clue helps a lot. So far, only our first list would work.

Winner                      Julia    Carley    Jack

**What does the 4<sup>th</sup> clue tell us?** Holden finished before Julia, but after Lilly; so we can just insert Holden between them.

Winner                      Lilly    Holden    Julia    Carley    Jack

Lilly was the winner.

Say:

**Look at problem 2. What is the problem asking?** (Who won the race and what was the order of the other candidates.) **What do the clues tell you?**

Clue 1: Winner Tom Pete

Clue 2: Winner Latitia Willy Margo or Margo Willy Latitia

Clue 3: Winner Latitia Willy Margo

Clue 4: Winner Latitia Willy Margo Craig

Clue 5: Winner Tom Pete Latitia Willy Margo Craig

Tom won the race.

⇒ Give Student Sheet 53 to the students.

Say:

**Look at problem 1. What is the problem asking?** (Which person has what occupation?) **What do the clues tell you?**

Clue 1: Dudley cannot be the teacher. Put an  $x$  in the teacher box for Dudley.

Clue 2: Kim cannot be the van driver. Put an  $x$  in the van driver box for Kim.

Clue 3: Isaac is the teacher. Put a check in the teacher box for Isaac. This process of elimination means that Kim and Dudley cannot be the teacher, so put  $x$  in the teacher boxes for them. It also means that Isaac cannot be the doctor or the van driver. Put  $x$ 's in those boxes. This process leaves Dudley as the van driver so Kim must be the doctor.

Say:

**Look at problem 2. What is the problem asking?** (Who owns which pet?) **What do the clues tell you?**

Clue 1: Selena cannot have the dog or cat. Put  $x$ 's in those boxes next to her name.

Clue 2: Buzz and Maria cannot own the bird. Put  $x$ 's in those boxes.

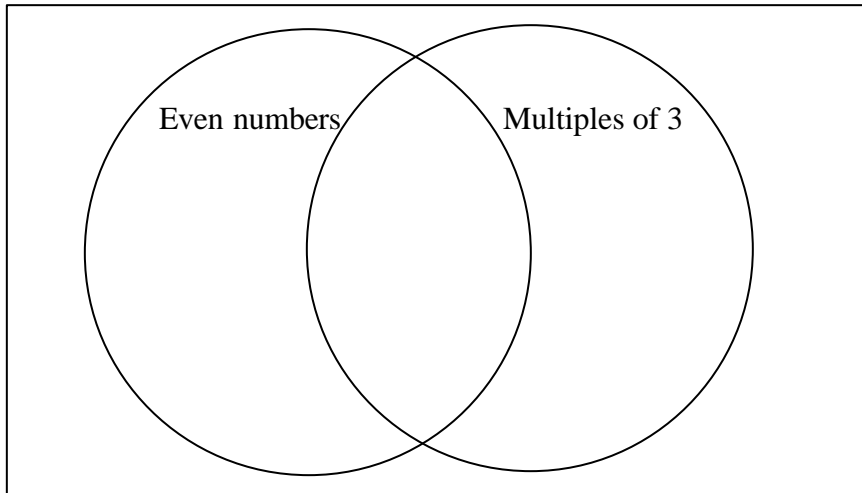
Clue 3: Selena could not have had lunch with Buzz, so she can't be the owner of the bird. Put an  $x$  in that box. Therefore, Selena must own the fish. Put a check in the box for fish. Therefore, no one else can own the fish, so put  $x$ 's in the fish box for Buzz, Maria, and Leroy. Since Buzz, Maria, and Selena don't own the bird, Leroy must. Put a check in the bird box for Leroy. Since Leroy owns the bird, he cannot own the other pets. Put  $x$ 's in the other Leroy boxes.

Clue 4: Maria has the dog. Put a check in that box. Therefore, Buzz cannot have the dog. Put an  $x$  in the dog box for Buzz. Since Maria cannot have the cat, put an  $x$  in that box for her. This process of elimination leaves Buzz with the cat.

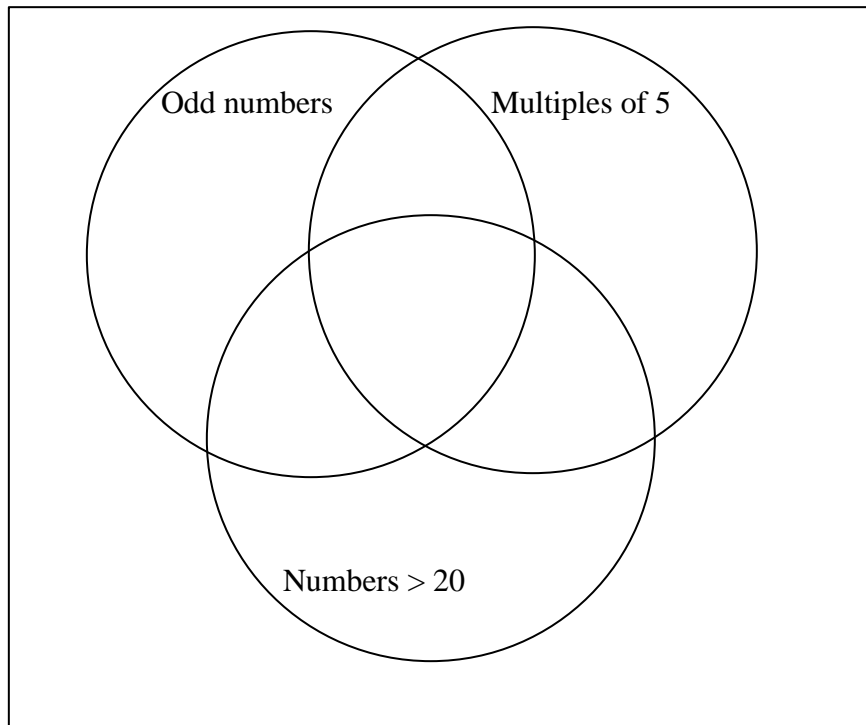
⇒ Have one student summarize today's lesson. Emphasize that using tables, charts, lists, or Venn diagrams can make logical reasoning problems much easier.

## Student Sheet 51 (Data Analysis: Lesson 3)

### Part A



### Part B



## Student Sheet 52 (Data Analysis: Lesson 3)

1. Carley, Holden, Jack, Julia, and Lilly were in a race.

Carley finished between Jack and Julia.

Lilly finished before Julia.

Jack finished in last place.

Holden finished before Julia, but after Lilly.

In what order did they finish the race?

2. Tom, Pete, Margo, Willy, Latitia, and Craig all ran for Secretary of State.

Someone gave you the following clues about the race.

Tom finished before Pete and no one was between them.

Willy finished between Latitia and Margo and was the only person between the two.

Margo finished next to last.

Craig finished after Margo.

Latitia finished after Pete.

Who won Secretary of State and what was the order of the rest of the candidates?

### Student Sheet 53 (Data Analysis: Lesson 3)

1. Dudley, Isaac, and Kim are a teacher, a doctor, and a van driver, although not in that order. Decide who has which occupation. The table will help you organize the information.

Dudley went to lunch with the teacher.

Kim does not know how to drive a van.

Isaac is the teacher.

	Teacher	Doctor	Van Driver
Dudley			
Isaac			
Kim			

2. Selena, Buzz, Maria, and Leroy each own one and only one pet – a cat, a dog, a bird, and a fish – although not in that order. Use the clues to determine who has which pet.

Selena is allergic to cat and dog hairs.

Buzz and Maria had lunch with the owner of the bird.

Selena has never meet Buzz.

Maria's pet barks a lot.

	Cat	Dog	Bird	Fish
Selena				
Buzz				
Maria				
Leroy				