LESSON 24
"Courts and Bounds"
Yvonne Garcia

CONCEPT AREA	Domain/Range/Reasonableness
GRADE LEVEL	4-5
TIME ALLOTMENT	90 minutes
LESSON OVERVIEW	We use ranges to estimate all the time. The students will relate what they know about boundaries on sports courts, such as basketball or volleyball. They will project possible answers that are within a certain range, create a table, and then determine if the answers are reasonable for the questions asked. This lesson allows intermediate-aged students to explore the range of space needed for games that will be placed in a new local game room.
LESSON ACTIVITIES OVERVIEW	Students should identify tables to be used as algebraic functions to find ranges. The students will work in groups to figure out the space they will need to fit all new game equipment into the area provided at the new game center. They should be able to explain the smallest and largest numbers in their range.
LEARNING OBJECTIVES	Students will be able to: • Identify numbers needed to calculate the ranges and determine reasonable answers using the ranges they find. • Use the problem-solving strategy of making a table.

STANDARDS (TEKS)	**From the Texas Essential Knowledge and Skills for Math (TEKS) for grades** 4-5:
	
	Grade 4
	    4.1A, B; 4.5B
	Grade 5
	    5.1A, B; 5.4B

MEDIA COMPONENTS	Video: *Math Can Take You Places* #003 *"Domain/Range/Reasonableness"* Internet: Six Flags Over Texas information http://www.sixflags.com
MATERIALS	Per class: • 20-25 calculators • Pictures from magazines, books or the Internet of soccer, basketball and baseball playing areas • 20-25 dry erase boards • Markers • Pictures of indoor games, such as bumper cars and simulators • Sports equipment, if available • 4-5 sheets of chart paper for each group • 2-5 books about basketball, volleyball, soccer and baseball from the library • 1-3 Web sites on any sports data • 1-2 pictures or a Web site showing Six Flags

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PREP FOR TEACHERS
- Teachers need to bookmark Web sites on the computers.
- Watch *Math Can Take You Places* and cue the videotape.
- Gather all materials needed for each group of students' hands-on elements of the lesson. Set up pictures and books of sports and Six Flags to get the students interested.
- Prior knowledge: The students need to have a knowledge of problem-solving strategies, such as organized lists, drawing pictures and making tables. Vocabulary: range

Note:

The concept of **range** will be covered during this lesson. Students may need to review the concepts prior to beginning the activities, especially if your class includes students who are acquiring English as a second language (ESL).

INTRODUCTORY ACTIVITY: SETTING THE STAGE

1. Discuss the following with the students: Sports are played at many different levels (little league, high school and professional). Most students have watched sports at some time in their lives or played sports in a PE class at school. Each sport has boundary lines. For example, at a major league or high school baseball field, the diamond is set at a 90-ft. by 90-ft. field. A little league baseball field is set at a 60-ft. by 60-ft. field.

When you go out of bounds in most sports, there is some type of penalty. Just like at school, there is a penalty for going outside the boundary of the rules.
- In basketball and soccer, the other team gets the ball.
- In softball or baseball, you might hear the umpire say "foul ball."
- At school, you may lose recess time or a special party privilege if you step over the boundaries.

But when you stay within these boundary lines, there is a large RANGE of possibilities. Staying within the boundaries of the rules at school allows a chance for students to win awards or special treats. When you investigate problems asking for ranges, think of the problem as discovering and determining reasonable boundary lines. You will need to use multiplication as you find the upper and lower amounts based on the fixed amount of times asked in the problem.

2. Work the following example with the students. Emphasize using the chart to make it easier to find the low and high number in the range.

Example:

If the fewest number of math problems given as homework is four and the largest number of problems that would be given number is nine, then about how many problems would be given in five nights?

Input	Process (times 5 nights)	Output
4	4 * 5	20
9	9 * 5	45

Solution: The students could be given anywhere between 20 to 45 homework problems over five nights. It can be written mathematically as "20-45." Explain that each boundary line is the largest or smallest possible answer for that problem, but any number in between will work.

Discussion: Ask the students to name strategies they use to solve difficult problems; i.e., problem-solving strategies, such as organizing lists, drawing pictures and making tables.

LEARNING ACTIVITIES

1. Say: "A new game center is getting ready to open. First, the owners of the game center need to determine how many of each game they can fit in the building. They must determine a range of space needed inside the building for each type of game since some require more space than others. The main games they need to situate are the following: ski simulators, bumper cars, motorcycles, basketball goals and baseball batting cages. The amount of space needed for each game is listed below. What are the possible ranges for the space needed to fit each of the games?

2. The students will work in small groups to determine the possible range of space for specific sections of the game center. Each group will be given two different games of which to find the range. Each group will be instructed to:

   a. Draw a triangle-shaped field and write a boundary on the sidelines.
   b. Work the problem out on chart paper showing the problem in a table format as in the example above.
   c. Write an equation that defines the situation.

When the groups are finished calculating, have them explain their steps, the number sentences/equations they used and what the reasonable range would be for the amount of room needed for their game.

For example: The number of ski simulators is y=21x where x is the number of simulators. The range is {1, 2, and 3}. Therefore the reasonable range for this is between $(1 \cdot 21) = 21$ and $(3 \cdot 21) = 63$ sq. ft.

The chart includes the following: games, the least and greatest numbers of each game that might be put in the game room and the area needed for each one.

	Least#	Most#	Space needed
Ski simulators:	1	3	21 sq. ft each
Bumper cars:	6	10	18 sq. ft each
Motorcycles:	3	6	12 sq. ft each
Baseball batting cages:	1	4	43 sq. ft each
Basketball goals	3	5	35 sq. ft each
Skee-Ball:	4	6	15 sq. ft each
Air hockey:	2	4	7 sq. ft each
Foosball:	2	7	6 sq. ft each

Groups:
   Ski Simulators/ Foosball
   Bumper cars/ Air Hockey
   Motorcycles/ Basketball Goals
   Baseball Batting Cages/ Skee-Ball

Answers:
   Ski Simulators: 21 to 63 sq. ft.
   Bumper Cars: 108 to 180 sq. ft.
   Motorcycles: 36 to 72 sq. ft.
   Baseball Batting Cages: 43 to 172 sq. ft.
   Basketball Goals: 105 to 175 sq. ft.
   Skee-Ball: 60 to 90 sq. ft.
   Air Hockey: 14 to 28 sq. ft.
   Foosball: 12 to 42 sq. ft.

CULMINATING ACTIVITY
As a group, discuss the possible answers. Have the students write in words the steps used to calculate a range, given a set of data.

CROSS-CURRICULAR EXTENSIONS
Art
   Illustrate what the game room might look like using construction paper and markers.

Science
   Conduct an experiment testing the temperature ranges of different liquids. For example, take the temperature of water. Then, add ice. Later, heat the water. Make a chart that lists the low and high temperatures. Test other safe liquids to see if they react in the same way.

REAL-WORLD CONNECTIONS
Students can do projects where they interview managers of businesses, such as department stores and fast-food places, to find the ranges that they use to predict how much inventory to purchase for certain holidays.

ASSESSMENT
Students will be evaluated using the "Range Assessment" handout. The solutions are listed below.
1) 144 to 270
2) 504 to 1008
3) $6 to $17
4) $10.20 to $17.10
5) 420 to 980
6) $6.80 to $11.96
7) $6 to $63.92
8) B) between 10 hours and 17 hours The range is from 10 hours 30 minutes to 17 hours 30 minutes

STUDENT HANDOUTS
"Range Assessment"

travelocity

KERA
UNLIMITED

Name_____ Date_____

Range Assessment

1) Bryce shoots baskets after school each day. Bryce normally shoots 30 shots a day, and at least makes 16 baskets each day. What is a reasonable range of the number of baskets Bryce will make in 9 days?

2) Jennifer is making chocolate chip cookies to bring for the school-wide end-of-the-year party. Each day she makes 3 dozen cookies. She decided that she would either bake for 2 weeks or 4 weeks. What is a reasonable range of the amounts of cookies she will make in these amounts of time?

3) Logan went to the store to buy some stickers. He saw that some fishing stickers were on sale for $1.50 a pack. But there were others that were big and had a lot of glitter and they cost $4.25 a pack. If he wanted to buy 4 packs to share with his friends at school, then what is the range of money he would need to save?

4) A new ice cream shop opened in town. Valerie was there on the first day. She wanted to buy 6 sundaes to share with friends. She saw that 1 scoop would only cost $1.70, but 3 scoops would cost $2. 85. What is the range of the amount of money she will need to pay for everyone if she does not know which one they will want?

5) Every day at practice Jared throws a football. The least amount Jared has ever thrown in a practice is 30 times. The most Jared has ever thrown is 70 times. What is the most reasonable range of times he would throw in 14 days of practice?

6) Brooke wanted to give one soda to each person in her class at the Christmas party. Her mother said that she would need to know a range of the amount of money she would need to give Brooke. There were 24 students in the class. When Brooke was at the store, she saw that the generic brand was 6 for $1.70, and the name brands were 6 for $2.99. What range should she give her mom?

7) When looking on the Internet, Jared saw that posters of professional football and soccer athletes were on sale. The small ones cost $0.75 each and the large ones cost $7.99. Since he just received his birthday money, he wanted to buy 8 posters. What is the range of the amount of money he needs to have when purchasing the 8 posters?

8) Each day Shannon and her mom spend from 30 to 50 minutes making cards for Valentine's Day. After 3 weeks, what is a reasonable total of the amount of hours they will spend making cards?

A) Between 5 hours and 9 hours   B) Between 10 hours and 17 hours
C) Between 500 minutes and 900 minutes   D) Between 630 minutes and 1,050 minutes

Range Assessment
Answer Key

1. 144 to 270
2. 504 to 1008
3. $6 to $17
4. $10.20 to $17.10
5. 420 to 980
6. $6.80 to $11.96
7. $6 to $63.92
8. B) between 10 hours and 17 hours The range is from 10 hours 30 minutes to 17 hours 30 minutes

MATH
Can Take You Places
Te Lleva a Muchos Lugares

LESSON 24
"El Campo y los Límites"
by Yvonne Garcia

Nombre_____ Fecha_____

Evaluación de los Límites

1. Bryce tira al cesto después de la escuela todos los días. Normalmente, Bryce tira 30 cestos por día, y por lo menos hace 16 cestos por día. ¿Cuáles serían los límites de canastas razonables que Bryce haría en 9 días?

2. Jennifer está preparando galletitas de chocolate para llevar a la fiesta de fin de año de la escuela. Cada día prepara 3 docenas de galletitas. Ella decidió prepararlas en 2 ó 4 semanas. ¿Cuál sería la escala razonable de galletitas, para un tiempo de 2 ó 4 semanas?

3. Logan fue a la tienda para comprar figuritas adhesivas. Vio algunas de peces en oferta por $1.50 el paquete. Pero había otros que eran grandes con mucho brillo que costaban $4.25 el paquete. ¿Si él quisiera comprar 4 paquetes para compartir con sus amigos en la escuela, cuáles serían los límites de ahorro de dinero que necesita hacer?

4. Una nueva heladería se abrió en la ciudad. Valerie estuvo allí el primer día. Quería comprar 6 helados para compartir con sus amigas. Vio que con una bola sola costaban solamente $1.70, pero con 3 bolas costaban $2. 85. ¿Cuáles son los límites de dinero que ella necesitará para pagar por todos si ella no sabe lo que ellos van a elegir?

5. Todos los días de práctica Jared hace un tiro de pelota de fútbol. La menor cantidad de tiros que Jared ha hecho en una práctica es 30 veces. La mayor cantidad que Jared ha tirado es 70 veces. ¿Cuáles serían los límites de tiros razonables que tiraría en 14 días de práctica?

6. En la fiesta de Navidad, Brooke quería dar una soda a cada persona de su clase. Su mamá, para darle el dinero, le dijo que necesitaba tener una escala del dinero que necesitaría. Había 24 estudiantes en la clase. Cuando Brooke estuvo en la tienda, vió que la marca genérica costaba $1.70 por 6 botellas, y que las de nombres de marca costaban $2.99. ¿Qué límites de dinero debe darle a su mamá?

7. Cuando Jared estaba mirando en la Internet, vio que los carteles de los jugadores profesionales de fútbol americano y los atletas de fútbol Sudamericano (soccer) estaban en oferta. Los pequeños costaban $0.75 cada uno y los grandes $7.99. Como justamente había recibido dinero en su cumpleaños, quería comprar 8 carteles. ¿Cuáles son los límites de dinero que necesita tener para comprar 8 carteles?

8. Todos los días Shannon y su mamá pasan juntas de 30 a 50 minutos haciendo tarjetas para el Día de San Valentine. Después de 3 semanas, ¿cuál sería el total de horas razonable que pasarían juntas haciendo tarjetas?

    A) Entre 5 horas y 9 horas   C) Entre 500 minutos y 900 minutos
    B) Entre 10 horas y 17 horas   D) Entre 630 y 1,050 minutos