## **Game: Playing Circles and Stars**

In this lesson, students will see multiplication as combining equal groups, use repeated addition and other strategies to find the total number of stars, and record answers by writing equations.

**NC Mathematics Standard(s):**

**Represent and solve problems involving multiplication and division.**

**NC.3.OA.1** For products of whole numbers with two factors up to and including 10:

* Interpret the factors as representing the number of equal groups and the number of objects in each group.
* Illustrate and explain strategies including arrays, repeated addition, decomposing a factor, and applying the commutative and associative properties.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them
2. Construct viable arguments and critique the reasoning of others
3. Model with mathematics
4. Use appropriate tools strategically
5. Attend to precision

**Student Outcomes:**

* + - * I can see multiplication as combining equal groups.
      * I can use repeated addition as a strategy to find the total number of stars.
      * I can use strategies to find the total number of stars.
      * I can record my answer by writing an equation.

**Materials**:

* + - * One six-sided die or a spinner for each pair of children
      * Game Recording Sheet per player
      * Data chart for Class

**Advance Preparation:**

Circles and Stars is a game that gives children a visual interpretation of multiplication and repeated addition. The game also helps students see multiplication as the combining of equal-sized groups that can be represented with a multiplication equation.

**Directions:**

* + - * The teacher should model this game by inviting a student to play as a partner.
      * This game can be introduced to the entire class. The teacher might play a game with another student to model the game. Use modeling and questioning to ensure understanding. **Teacher:** Player One rolls the die and draws the corresponding number of circles at the top on the top row of the recording sheet. If the player rolls a 4, the player will draw 4 circles
      * **Student:** Player Two rolls the die and draws the corresponding number of circles in the round one box on his/her recording sheet. If player two rolls a 1, the player will draw 1 circle.
      * **Teacher:** Player One rolls the die a second time and draws the corresponding number of stars in each circle. (An option may be to draw Xs which are easier to draw.) If a player rolls a 2, the player will draw 2 stars in each circle. (See Player One’s (Jack) recording sheet.) Player records both the addition and multiplication equation for each round. Many students will need to record both equations to move them from repeated addition to multiplication. Later, they might just record for multiplication.
      * **Student:** Player 2 rolls a second time and draws the corresponding number of stars on his/her recording sheet. Player 2 records equations.
      * **Teacher and Student:** Each player should record his/her name and partner’s name in the top left corner of the player’s recording sheet. At the end of the game, each player will total his/her total stars for each round and record the total in the top left box. Record partner’s score and record the difference between the two scores.

Circle and Stars Recording Sheet

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Jack’s total Partner’s total Difference | \*\* \*\*  \*\* \*\*  2 + 2 + 2 + 2 =8  4 x 2 = 8 |  |  |  |
|  |  |  |  |  |

* + - * Both players repeat these steps until all boxes are filled.
      * Each player finds the total number of stars on his/her game sheet. Players need to check each other’s work.
      * Each player records own score plus partner’s score. Find the difference and record.
      * Many students will need to record both equations to move them from repeated addition to multiplication. Later, they might just record for multiplication.

**Questions to Pose:**

Before:

* + - * If your die had a zero and your first roll was a 5 and your second roll was a zero? Explain how you would record?

During:

* + - * What numbers did you represent in different ways? Compare with your partner. Explain.
      * What other observations did you make as you were playing this game? Explain.

After:

* + - * What is the fewest number of stars you can get in one round? Explain.
      * What is the greater number of stars you can get in one round? Explain.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| Students get confused when thinking about the number of groups and the number in each groups  Students add the two numbers without thinking about number of groups | Students need to explain what the circles represent and what the stars in each circle represent. |

**Special Notes:**

Extensions:

1. Game Play
   * Play the game using a 1-9 die or 0-9 spinner.
   * Players record multiplication and the related division fact followed by an explanation. 4 x 2 = 8 4 circles with 2 stars in each circle

8 ÷ 2 = 4 8 stars divided into 4 groups There are 2 stars in each group.

1. **Class Data Chart** (Prepare before lesson. See attached page.)
   * Teacher should list all numbers 1-36 on a chart using column format. (Thirty six is the largest product possible product using two (1-6) dice.
   * Show the class the Circle and Stars Data Chart.
   * Teacher selects one student and the student’s recording sheet. Teacher and student model how to use tally marks to record the student’s scores for each round on the Class Data Chart. Tell students they are to play more games of Circles and Stars. As students complete their recording sheet, ask students to make tally marks on the class chart to show the number of stars he/she had for each **round**. Suggest that if one partner reads each score, the other partner can record tally marks on the Class Data Chart. Encourage students to play many games.
2. Discuss the data

After all students have played several games and recorded their products for each round on the class chart, elicit students in conversations about the data. Ask: “Why did I write the numbers 1-36 on the chart?”

1. Are there numbers that are impossible using a (1-6) die? Explain.
2. Why do some numbers have more tally marks than other numbers? Explain.
3. What are the ways to get 2 as an answer? Ways for 6? Ways for 12? (Students might think about this with a partner or in small groups. Record equations.)
4. Which number(s) 1-36 has the most combinations using two 1-6 dice? What numbers can I skip count by to say this number? (Relate numbers on dice to factors in multiplication equations.
5. *You can skip count by both factors and land on the number, which is the product.* Is this always true? Ask students to test this idea. Some may want to test larger numbers.
6. Is there a product that can only be represented one way? Why? Explain.
7. What other observations do you notice about the data?
8. How might this data be useful for thinking about multiplication combinations (facts)?

*Adapted from About Teaching Mathematics by Marilyn Burns.*

**Circles and Stars – Data Collection**

1. 19.

2. 20.

3. 21.

4. 22.

5. 23.

6. 24.

7. 25.

8. 26.

9. 27.

10. 28.

11. 29.

12. 30.

13. 31.

14. 32.

15. 33.

16. 34.

17. 35.

18. 36.

**Circles and Stars Recording Sheet Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |
| --- | --- | --- |
| **Players**  Total  Partner’s Total  Difference \_\_\_\_\_\_\_\_\_\_\_\_ | **Round 1** | **Round 2** |
| **Round 3** | **Round 4** | **Round 5** |
| **Round 6** | **Round 7** | **Round 8** |

Total Number of Stars \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_