**Grasshopper Legs**

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| In this lesson, students explore multiplication and division concepts through the use of numberless word problems and use various strategies to solve a second problem. |

**NC Mathematics Standard:**

**Operations and Algebraic Thinking**

**NC.3.OA.3** Reason, interpret, and solve one-step problems involving multiplication and division.

* Solve multiplication word problems with factors up to and including 10. Represent the problem using arrays, pictures, and/or equations with a symbol for the unknown number to represent the problem.
* Solve division word problems with a divisor and quotient up to and including 10. Represent the problem using arrays, pictures, repeated subtraction.

**Additional/Supporting Standards:**

**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.

**NC.3.OA.2** For whole-number quotients of whole Numbers with a one-digit divisor and a one-digit quotient:

* Interpret the divisor and quotient in a division equation as representing the number of equal groups and the number of objects in each group.
* Illustrate and explain strategies including arrays, repeated addition or subtraction, and decomposing a factor.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

4. Model with mathematics.

7. Look for and makes use of structure.

8. Look for and express regularity in repeated reasoning.

**Student Outcomes:**

* I can solve multiplication word problems using pictures to represent the problem.

**Math Language:**

* **equal groups, repeated addition/subtraction, division/multiplication**

**Materials:**

* paper, pencil, counters, whiteboards with markers (optional), activity sheets, Lesson PowerPoint (optional)

**Advance Preparation**:

* The launch could be presented on a projector. You may use [this PowerPoint](https://drive.google.com/file/d/1ITRNyszulSoK6ROXpCGEb_y9jY_wNG5U/view?usp=sharing) for the launch.

**Launch:**

1. Introduce numberless word problem (5-10 minutes)

Ask students: What do you know about grasshoppers? What do they do? Consider showing a picture or a very brief video of a grasshopper. Ask: What do you notice? What do you wonder? Students record their noticings and wonderings on a whiteboard or the activity sheet, or you may just prefer that they discuss them orally.

To continue to launch the task, present the word problem that does not include any numbers:

First Problem (no numbers):

**You see a group of grasshoppers on the ground. If you see some legs, how many grasshoppers are there?**

Guided questions:

* What do you know from this situation? What would it look like?
* How could you draw this picture?
* How could we figure out how many grasshoppers there were if we know the number of legs on the ground? (Draw each grasshopper with 6 legs until you have the total legs, take the legs and divide by 6, etc.)

Now add the numbers to the problem:

**Grasshoppers have 6 legs. You see a group of grasshoppers on the ground. If you see 48 legs, how many grasshoppers are there? Model the problem and show how you solved.**

**Explore:**

1. Solving the Grasshopper Task (10 minutes)

Allow students to work individually and then with partners to solve the task. Provide counters or other manipulatives to create equal groups. As students work, observe them to see how they solve the task. Encourage students to share their strategies with one another and describe how they are answering the question.

While students work the teacher will monitor their progress and can ask these questions to evoke deeper thinking or explain their thought process:

* Can you explain your strategy to me?
* What does this picture show/represent?
* What do we know from the problem? How can we draw that? (If a student is stuck)
* How else could we show this problem? (extension)

Observe:

* How are students organizing and representing their thinking?
* How do students make sense of the problem, considering the number of legs and the number of grasshoppers?
* What vocabulary are students using as they solve the task?
* Consider using the [“Planning for Mathematical Discourse” tool](https://docs.google.com/document/d/1WGFGMXRl7OStRaAFqLHRbdLw0JLLD2-ea0aI5YO_dOw/edit?usp=sharing) as you monitor.

If a student is stuck, you could consider asking: What is the problem asking? What information do you know? How can you start to solve this problem? Tell me about the strategy you used to solve the problem.

If students finish quickly, consider the extension below.

Carefully select students to present their solutions to the task. Look for students who modeled the problem with manipulatives and kept track of the number of legs in relation to the number of grasshoppers. Did anyone use a table to keep track of legs? Look for strategies that will generate discussion to help others move toward a deeper understanding of the relationship between operations, and the relationship between the number of legs and the number of grasshoppers. Be sure to ask questions to emphasize the connections between the different strategies/representations used.

**Discuss:**

1. Class Discussion of Task Solutions (10 minutes)

Bring the group back together and have selected students share their strategies for solving the task. Have students present their work (consider the [“Planning for Mathematical Discourse”](https://docs.google.com/document/d/1WGFGMXRl7OStRaAFqLHRbdLw0JLLD2-ea0aI5YO_dOw/edit?usp=sharing) sheet, if used). Students can present their work displayed with a document camera, or explain their strategy as they (or the teacher) shows on the board using their explanation. Students could also use their own whiteboard to show their strategies as they explain what they did to solve.

**Evaluation of Student Understanding**

**Informal Evaluation:**

Observe and monitor students as they solve the problem. How are they making sense of the problem? Are they using mathematical vocabulary as they solve and discuss the problem? How are students relating the number of legs to the number of grasshoppers?

**Formal Evaluation/Exit Ticket:**

Now that we know how many grasshoppers there are, what if I wanted to know how many eyes there are? Solve.

**Meeting the Needs of the Range of Learners**

**Intervention:** Students can solve similar problems with smaller numbers. Students should use manipulatives to aid in solving the problem.

**Extension:** Students can create a similar word problems of their own, or you could give them another number of legs (24, 120, etc.). What is a number of legs that we would not see in a field where there are only grasshoppers (who have all their legs)? Why?

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students might try to multiply 6 x 48. | Question students to make sure that they understand exactly what information they are trying to solve. |

**Special Notes:**

* The standard NC.3.OA.3 requires students to reason, interpret, and solve one-step problems involving multiplication and division. This standard specifies working with arrays, which may or may not be addressed in this task (depending on student strategies). It is not required that students use arrays to solve this problem, so you would need to plan for a lesson that intentionally incorporates arrays to meet the full expectation of this standard.

**Possible Solutions:**

Solutions should include drawings and/or words to model the solution strategy.

IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII = 8 grasshoppers

6 12 18 24 30 36 42 48 legs = 8 grasshoppers

6 + 6 + 6 + 6 + 6 + 6 + 6 + 6 = 48 legs

1, 2, 3, 4, 5, 6, 7, 8 grasshoppers

6 x \_\_ = 48

8 grasshoppers

48 ÷ 6 = 8

**Activity Sheet 1**

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| You see a group of grasshoppers on the ground. If you see some legs, how many grasshoppers are there? | **What do you notice?** |
| **What do you wonder?** |

**Activity Sheet 2**

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| Grasshoppers have 6 legs. You see a group of grasshoppers on the ground. If you see 48 legs, how many grasshoppers are there? | **Picture/Strategy** |
| **Solution** |