**Multiplicative Comparison Mountain Task**

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| In this lesson, students will apply the concept of multiplicative comparisons by solving multiplication/division problems set within the context of the North Carolina Mountains. |

**NC Mathematics Standards:**

**Operations and Algebraic Thinking**

**NC.4.OA.1** Interpret a multiplication equation as a comparison. Multiply or divide to solve word problems involving multiplicative comparisons using models and equations with a symbol for the unknown number. Distinguish multiplicative comparison from additive comparison.

**Number and Operations in Base Ten**

**NC.4.NBT.1** Explain that a multi-digit whole number, a digit in one place represents 10 times as much as it represents in the place to its right, up to 100,000.

**Standards for Mathematical Practice:**

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

2. Reason abstractly and quantitatively.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**Student Outcomes:**

* I can understand multiplicative comparisons.

**Math Language:**

* multiplicative comparison
* compare
* multiply
* divide

**Materials:**

* pictures of the following North Carolina mountains:
  + - Pilot Mountain
    - Stone Mountain
    - Grandfather Mountain
    - Sugar Mountain
    - Mount Mitchell
    - Brown Mountain
    - Occoneechee Mountain
    - Grandmother Mountain
* student handout (1 per student)
* independent practice handout (1 per student)

**Advance Preparation**:

* Collect pictures of the North Carolina mountains to show students as a hook
* Make copies of the student handouts and independent practice handouts (1 per student)

**Launch:**

1. Introduce Problem (5 minutes)

Ask students if they have ever been to the North Carolina Mountains? What mountain have you been to and what did you do there? Show pictures of the different North Carolina Mountains and discuss where they are located in North Carolina.

Give students the following problem:

*North Carolina is home to many different mountains.  Each of the mountains has a different height or elevation.  Use the clues to complete the chart and answer the questions about the mountains of North Carolina. \*These elevations are not exact and have been rounded.*

|  |  |  |
| --- | --- | --- |
| Mountain | Equation | Elevation |
| Pilot Mountain |  |  |
| Stone Mountain |  |  |
| Grandfather Mountain |  |  |
| Sugar Mountain |  |  |
| Mount Mitchell |  |  |
| Brown Mountain |  |  |
| Occoneechee Mountain |  |  |
| Grandmother Mountain |  |  |

Use the following clues to complete the chart:

* Pilot Mountain is four times as tall as an elevation of 625 feet.
* Sugar Mountain is twice as high in elevation as Pilot Mountain.
* Brown Mountain is 500 feet more than Pilot Mountain.
* Grandfather Mountain is twice as high as Brown Mountain.
* Mount Mitchell is 1,000 more than twice the elevation of Pilot Mountain.
* Grandfather Mountain is 1,000 feet less than twice Brown Mountain.
* Occoneechee Mountain is 6 times smaller than Grandfather Mountain.
* Stone Mountain is two times smaller than Grandmother Mountain.

1. How many times more is the elevation of Brown Mountain than the elevation of Occoneechee Mountain?

2. If Mount Mitchell and Grandfather Mountain were stacked on top of each other, how many times higher would they be compared to Brown Mountain?

3. If Sugar Mountain and Grandmother Mountain were stacked on top of each other, how many times higher are they than Stone Mountain?

4. How much smaller is Occoneechee Mountain from Pilot Mountain and Stone Mountain put together?

**Explore:**

1. Solving the Problem (15 – 20 minutes)

Allow students time to work individually and then with partners in order to solve the task. As students work, observe students to see how they are solving the task. Encourage students to share their strategies with one another and describe how they are answering each question.

Observe:

* + How are students organizing and representing their thinking?
  + How do students make sense of the numbers in the clues?
  + How do students determine the elevation of each mountain?
  + What vocabulary are students using as they solve the task?

Carefully select students to present to the class. Students need to be showing the equation for each one of the multiplicative comparisons. Monitor to make sure students are multiplying or dividing correctly.

**Discuss:**

1. Discussion of Solutions (15 – 25 minutes)

Bring the group back together and have selected students share their strategies for solving the task.

Suggested questions to probe for deeper thinking:

* How did you start solving the task?
* Why is it important to start with the elevation of Pilot Mountain?
* How does understanding multiplication help solve this task?
* Why is it so important to understand when you are multiplying and when you are dividing?
* Which clue was the hardest to understand?
* Why was it the hardest to understand?
* Can you make another clue based on the information in the chart?
* Students should be able to discuss how they solved the problem and how they used multiplicative comparisons when doing so. Discuss with students the three different types of multiplicative comparison problems and how they used them when they were solving this task. Why is it important to know the three different types of multiplicative comparisons (smaller part unknown, larger part unknown, and multiplier unknown)? How does it help to understand the task?

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe and monitor students as they solve the problem. How are they making sense of each problem?

**Formal Evaluation/Exit Ticket:**

* At the end of the lesson, give students the independent practice sheet as a formal evaluation or exit ticket.

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

**Interventions:**

* Allow students to work with grid paper and manipulatives. This will help cement the understanding of “times as much” when they are realizing how many times more or how many times less an elevation is.

**Extensions:**

* Have students create three of their own multiplicative comparison word problems using all three types of multiplicative comparisons (smaller part unknown, larger part unknown, and multiplier unknown) combining the elevation of two or more mountains.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| * Students may multiply or divide the wrong numbers when working on the chart | * Have students look back at their chart and see if all the clues match their answers. How can they look at the problems differently to understand? * Give students manipulatives to better visualize the concept and the task. |

**Special Notes:**

* While the standards NC.4.NBT.4 and NC.4.NBT.5 only require students to solve multiplication and division problems up through three-digits, this task does deal with four-digit numbers. The numbers are all multiples of ten and can easily be multiplied and divided using multiples of ten (NC.4.NBT.1).

**Solutions:**

|  |  |  |
| --- | --- | --- |
| **Mountain** | **Equation** | **Elevation** |
| Pilot Mountain | **625 x 4 = 2,500** | **2,500 ft.** |
| Stone Mountain | **5,000 2 = 2,500** | **2,500 ft.** |
| Grandfather Mountain | **3,000 x 2 = 6,000** | **6,000 ft.** |
| Sugar Mountain | **2,500 x 2 = 5,000** | **5,000 ft.** |
| Mount Mitchell | **2,500 x 2 = 5,000**  **5,000 + 1,000 = 6,000** | **6,000 ft.** |
| Brown Mountain | **2,500 + 500 = 3,000** | **3,000 ft.** |
| Occoneechee Mountain | **6,000 6 = 1,000** | **1,000 ft.** |
| Grandmother Mountain | **3,000 x 2 = 6,000**  **6,000 – 1,000 = 5,000** | **5,000 ft.** |

1. How many times more is the elevation of Brown Mountain than the elevation of Occoneechee Mountain? **3 times as high - 3,000 1,000 = 3**

2. If Mount Mitchell and Grandfather Mountain were stacked on top of each other, how many times higher would they be compared to Brown Mountain? **3 times as high – 12,000 4,000 = 3**

3. If Sugar Mountain and Grandmother Mountain were stacked on top of each other, how many times higher are they than Stone Mountain? **4 times as high – 10,000 2,500 = 4**

4. How much smaller is Occoneechee Mountain than Pilot Mountain and Stone Mountain put together? **5 times as high – 5,000 1,000 = 5**

**North Carolina Mountains**

North Carolina is home to many different mountains.  Each of the mountains has a different height or elevation.  Use the clues to complete the chart and answer the following questions about the mountains of North Carolina. \*These elevations are not exact and have been rounded.

|  |  |  |
| --- | --- | --- |
| **Mountain** | **Equation** | **Elevation** |
| Pilot Mountain |  |  |
| Stone Mountain |  |  |
| Grandfather Mountain |  |  |
| Sugar Mountain |  |  |
| Mount Mitchell |  |  |
| Brown Mountain |  |  |
| Occoneechee Mountain |  |  |
| Grandmother Mountain |  |  |

* Pilot Mountain is four times as tall as an elevation of 625 feet.
* Sugar Mountain is twice as high in elevation as Pilot Mountain.
* Brown Mountain is 500 feet more than Pilot Mountain.
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* Mount Mitchell is 1,000 more than twice the elevation of Pilot Mountain.
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1. How many times more is the elevation of Brown Mountain than the elevation of Occoneechee Mountain?

2. If Mount Mitchell and Grandfather Mountain were stacked on top of each other, how many times higher would they be compared to Brown Mountain?

3. If Sugar Mountain and Grandmother Mountain were stacked on top of each other, how many times higher are they than Stone Mountain?

4. How much smaller is Occoneechee Mountain than Pilot Mountain and Stone Mountain put together?

**North Carolina Mountain Independent Practice**

Use the chart below to answer the following questions.



|  |  |
| --- | --- |
| **Mountain** | **Elevation** |
| Pilot Mountain | 2,500 ft. |
| Grandfather Mountain | 6,000 ft. |
| Stone Mountain | 2,500 ft. |
| Sugar Mountain | 5,000 ft. |
| Occoneechee Mountain | 1,000 ft |

1. The tallest mountain in the United States of America is Denali which is located in Alaska. Denali is about 20,000 feet tall. How many times taller is Denali than Sugar Mountain?

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2. How many times smaller is Pilot Mountain than Denali?

3. Mount Fairweather is also located in Alaska and is about 15,000 feet tall. How many times taller is Mount Fairweather than Sugar Mountain?

4. How many times smaller is Occoneechee Mountain than Mount Fairweather?

5. How many times taller is Denali than Stone Mountain, Sugar Mountain, and Pilot Mountain combined?

**ANSWER KEY**

**North Carolina Mountain Independent Practice**

Use the chart below to answer the following questions.



|  |  |
| --- | --- |
| **Mountain** | **Elevation** |
| Pilot Mountain | 2,500 ft. |
| Grandfather Mountain | 6,000 ft. |
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| Sugar Mountain | 5,000 ft. |
| Occoneechee Mountain | 1,000 ft |

1. The tallest mountain in the United States of America is Denali which is located in Alaska. Denali is about 20,000 feet tall. How many times taller is Denali than Sugar Mountain?

**4 times taller – 20,000 5,000 = 4**

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2. How many times smaller is Pilot Mountain than Denali?

**8 times smaller - 2,500 X 8 = 20,000**

3. Mount Fairweather is also located in Alaska and is about 15,000 feet tall. How many times taller is Mount Fairweather than Sugar Mountain?

**3 times taller – 15,000 5,000 = 3**

4. How many times smaller is Occoneechee Mountain than Mount Fairweather?

**15 times smaller - 1,000 X 15 = 15,000**

5. How many times taller is Denali than Stone Mountain, Sugar Mountain, and Pilot Mountain combined?

**2 times taller – 20,000 10,000 = 2**