Compare Numbers

Students are given pairs of numbers written in scientific notation and are asked to compare them multiplicatively.

General Information

Subject(s): Mathematics
Grade Level(s): 8
Intended Audience: Educators

Freely Available: Yes

Keywords: MFAS, one-digit numbers, powers of ten, compare

Instructional Component Type(s): Formative Assessment

Resource Collection: MFAS Formative Assessments

Attachment

MFAS_CompareNumbers_Worksheet.docx

Formative Assessment Task

Instructions for Implementing the Task
This task can be implemented individually, with small groups, or with the whole class.

1. The teacher asks the student to complete the problems on the *Compare Numbers* worksheet.
2. The teacher asks follow-up questions, as needed.

TASK RUBRIC

Getting Started

Misconception/Error

The student converts the numbers to standard form in order to compare them.

Examples of Student Work at this Level

The student converts each number to standard notation and then divides to compare. The student may or may not correctly interpret the result.

Questions Eliciting Thinking

Can you compare these numbers without converting them to standard notation?

Do you know how many times larger 10^2 is than 10^1 (or 10)? Can you tell just by looking at the exponents?

What does 10^2 mean? How many factors of 10 are in 10^2? So how does 10^2 compare to 10?

Instructional Implications

Have the student rewrite each number as a product of factors, (e.g., $6 \times 10^4 = 6 \cdot 10 \cdot 10 \cdot 10 \cdot 10$ and $6 \times 10^2 = 6 \cdot 10 \cdot 10$). Ask the student to compare the numbers in this form and determine how many more factors of 10 are in 6×10^4 than in 6×10^2. Do the same for the other two problems. Then provide additional opportunities to compare numbers written as a single digit times a power of 10. Guide the student to observe the general rule for dividing exponential expressions with the same base. Help the student appreciate how easy it is to compare two numbers each written in the form $a \times 10^n$ with equal values of a.

Provide the student with problems in which numbers must first be converted to scientific notation and then compared.

Moving Forward

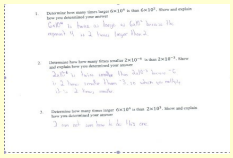
Misconception/Error

The student attempts to compare the numbers in exponential form but makes significant errors.

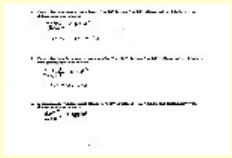
Examples of Student Work at this Level

The student:

- Compares exponents and indicates that 6×10^4 is two times larger than 6×10^2 since four is twice as large as two, and $2 \times$ [redacted] is two times larger than 2×10^{-6} since -3 is twice as large as -6.



- Makes an error when subtracting exponents or when dividing whole numbers.



Questions Eliciting Thinking

What does 10^2 mean? How many factors of 10 are in 10^2? What does 10^4 mean? How many factors of 10 are in 10^4? So how does 10^2 compare to 10^4?

What does 10^{-3} mean? What does 10^{-6} mean? Can you write these numbers as fractions?

Instructional Implications

Have the student rewrite each number as a product of factors, (e.g., $6 \times 10^4 = 6 \cdot 10 \cdot 10 \cdot 10 \cdot 10$ and $6 \times 10^2 = 6 \cdot 10 \cdot 10$). Ask the student to compare the numbers in this form and determine how many more factors of 10 are in 6×10^4 than in 6×10^2. Do the same for the other two problems. Then provide additional opportunities to compare numbers written as a single digit times a power of 10. Guide the student to observe the general rule for dividing exponential expressions with the same base.

Pair the student with a Getting Started partner and have the students work on problems similar to those in this task. Ask students to compare answers and reconcile any differences.

Almost There

Misconception/Error

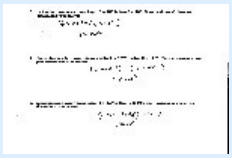
The student does not interpret his or her answer correctly.

Examples of Student Work at this Level

The student correctly divides each pair of expressions but is unable to correctly interpret the results. The student leaves the quotients in exponential form and:

- Says that 6×10^4 is two times larger than 6×10^2 since $\frac{6 \times 10^4}{6 \times 10^2} = 1 \times 10^2$ and the exponent is two.
- Says only that one number is larger or smaller than the other.

- Provides no interpretation of the result.



Questions Eliciting Thinking

Can you write your quotients in standard notation? What do these values indicate about how many times larger one number is than the other?

Can you be more specific? How many times larger is 6×10^4 than 6×10^2?

Instructional Implications

Provide additional opportunities to compare numbers written in the form $a\times10^n$. Have the student work with a partner to compare answers and reconcile differences.

Provide guidance on how to show mathematical work appropriately. Have the student justify his or her work by stating a rule of exponents.

Got It

Misconception/Error

The student provides complete and correct responses to all components of the task.

Examples of Student Work at this Level

The student compares the numbers in exponential form getting (1) 10^2 or 100; (2) [ ] or 1000; (3) 3 x 10 = 30.

Questions Eliciting Thinking

Can you explain why you subtracted the exponents when you divided 10^4 by 10^2?

How would you complete this problem: $(4\times10^5)\times(3\times10^4)$? Can you put your answer in scientific notation?

Instructional Implications

Provide the student with additional problems involving all four operations with numbers written in scientific notation (see 8.EE.1.4).

Accommodations & Recommendations

Special Materials Needed:

Compare Numbers worksheet

Source and Access Information

Contributed by: MFAS FCRSTEM
Name of Author/Source: MFAS FCRSTEM
District/Organization of Contributor(s): Okaloosa
Is this Resource freely Available? Yes
Access Privileges: Public
License: CPALMS License - no distribution - non commercial

Aligned Standards

Name	Description
MAFS.8.EE.1.3:	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 × 10^8 and the population of the world as 7 × 10^9, and determine that the world population is more than 20 times larger.*