Missing Key Dilemma

Holy cow!! My calculator does not have a 3 key that works! How can I use this broken calculator to do this problem?

$$\begin{array}{r} 23 \\ \times 45 \\ \hline \end{array}$$

Explain your reasoning carefully and clearly.

Grade Levels 3 - 5

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Context

We had been studying multiplication and doing some mental math and talking about different strategies. I wanted to know if my students knew the theory behind multiplication, not just how accurate they were with the algorithm.

What This Task Accomplishes

This task will tell me if students really know what multiplication does, how it works and how flexible their thinking is.

What the Student Will Do

Most students solved the problem using the algorithm first. Then they began to try different strategies. Some students had to test out their theories to be sure they worked. Other students were confident that their strategy would work.

Time Required for Task

15 - 20 minutes

Interdisciplinary Links

This task is purely mathematical; there are no interdisciplinary links.

Teaching Tips

You might want to include this task as part of a test on multiplication. It reinforces the fact that

algorithms need to be understood, not just memorized.

Suggested Materials

None

Possible Solutions

There are so many ways to approach this problem. Some possible solutions are:

22 x 45 + 45

24 x 45 - 45

Added 23 times or 23 added 45 times

11.5 x 90

22.5 x 46

(Use two numbers whose sum is 23) x 45

Benchmark Descriptors

Novice
Inappropriate concepts are applied. The student thinks that the strategy for addition (move one number up on the number line and the other number down on the number line) will also work with multiplication. His/her mathematical reasoning is faulty.

Apprentice
The solution is not complete. The student found an estimate, not the exact answer. The student's solution is partially useful, leading some way to the solution, but not a full solution.

Practitioner
This student has a broad understanding of the problem. S/he uses a strategy that leads to a solution of the problem and uses effective reasoning in a clear explanation.

Expert
This student has multiple solutions, showing a deep understanding of the problem. S/he has the ability to identify the appropriate mathematical concepts.