Zeno the Xylophone Maker

There are 13 keys on a xylophone (C, D, E, F, G, A, B, C, D, E, F, G and A).

The 1st key (C) is 7.5 inches long. The 2nd key (D) is 7.25 inches long. The 3rd key (E) is 7 inches long.

...and so on continuing this pattern in size.

Zeno the xylophone maker was about to begin construction on a new xylophone when he realized he had run out of metal stripping used to make the keys. This metal stripping comes in 1-yard pieces.

How many 1-yard pieces does Zeno need to buy in order to make 1 xylophone?

Grade Levels 3 - 5

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Context

This problem was given to my students after a unit on fractions and decimals. Students had used base-10 manipulative pieces to explore decimals and their relationship to fractions. I wanted to present them with a problem that would help me assess how well they understood the concepts presented in class, as well as provide them with an opportunity to apply the knowledge they learned to a new situation.

What This Task Accomplishes

In grades K-4, the mathematics curriculum should include fractions and decimals so that students can develop concepts of fractions mixed numbers and decimals; develop number sense for fractions and decimals; use models to relate fractions to decimals and find equivalent fractions; use models to explore operations on fractions and decimals; and apply fractions and decimals to problem situations.

Source: NCTM Curriculum and Evaluation Standards, 1989.

This problem also addresses several other NCTM standards including patterns, measurement and computation.

According to the NCTM standards, "Decimal instruction should include informal experiences that relate fractions to decimals so that students begin to establish connections between the two systems...Such activities help children develop number sense for decimals."

Source: NCTM Curriculum and Evaluation Standards, 1989.



What the Student Will Do

Most students will find the pattern either by creating an organized list, or using a ruler and drawing the keys to discover the pattern.

Time Required for Task

60 minutes

Interdisciplinary Links

When creating this problem, I measured an actual xylophone. Xylophones come in different sizes, so students could explore different-sized xylophones to see if the key size proportions are the same. Students could also create their own problems about other musical instruments. You could also explore the weight of the keys and their mathematical relationships.

Teaching Tips

Although I used an actual xylophone when creating the problem, I did not let the students use the xylophone to measure the keys. You could, however, provide a special needs, or lower ability student with the actual xylophone and change your objectives of the problem to a measurement assessment.

Suggested Materials

- Rulers
- Yard sticks
- Base-10 pieces
- Calculators

Possible Solutions

Students should find that you need 78 inches of metal to make a xylophone and that would require the maker to purchase three yards.

Benchmark Descriptors

Novice

A solution that shows a misunderstanding of the problem. A solution that makes no mathematical conclusion and does not find a pattern or how many yards are needed. A solution that has a solution which has no relationship to the task. A solution that shows no understanding of decimals and adds the three presented sizes or might multiply 13 by one of the sizes.

Apprentice

A solution that shows an attempt to find the pattern, but has an incorrect solution. A solution that shows some understanding of the problem, but has a random or weak explanation of strategy. A solution that shows a weak understanding of decimals and may think the pattern simply repeats the given (7.5, 7.25, 7, 6.5, 6.25, etc.) skipping the .75 inches. A solution that fails to transfer the solution to figure how many yards in all are needed. A solution that may use a yard stick end-to-end to "add up" how many yard sticks are needed.

Practitioner

A solution that shows understanding of the pattern and arrives at a correct solution with a sufficient explanation of the strategy used. The Practitioner uses an addition calculation to obtain an accurate solution.

Expert

A solution that generalizes knowledge from previous mathematical experiences with fractions and/or decimals. A solution that successfully creates multiple solutions and elaborates on the process or strategy used. A solution that discusses what size keys to cut from which pieces of metal to avoid waste. A solution that discusses how much metal is left over and how the pattern decreases by .25. A solution that describes the relationships between the decimal and fraction equivalents.

Novice



Apprentice

We just finished a problem. The problem was called Zono the Xylophone maker. The problem was to find out how many yards of iron he would need to make a xylophone. So we needed to find but a pattern that was already started so we needed to finish it. So the pattern is shown below, the pattern goes down by guarters. Here's the pattern.

7.5° 7.25°	Some math language is used to communicate the solution. 4.5	4"5 A
7"	4"75	-4."75 G-
6.75° (4.5°	Only part of the problem is $5^{\prime\prime} 5^{\prime\prime}$ Understood. The student finds	F
6.25" 6*	a pattern and completes it. 5'255)5 ne
5 .75 "	5.55	5D
5.5"	5".75 5".	Kc
5.25° 5'	6"6"	6
4.75"	半日 6.25 6.25	5A
4.5"	6.5 6"5	6
The stud	lent neglects	F
	<u> </u>	E
	7. 25 1.25	D
	7.515	C

Practitioner



Practitioner



Expert

